05-27-03 CP 4200$

Attorney Docket No. 29195.8171US

Express Mail Label EV343591657US

C of C 18

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE PATENT APPLICATION NO.:	6,197,181
APPLICATION NO.:	09/045,245
FILED:	MARCH 20, 1998
ISSUED:	MARCH 6, 2001
FOR:	**METHOD FOR ELECTROLYTICALLY DEPOSITING METAL ON A MICROELECTRONIC WORKPIECE**

PETITION TO CORRECT INVENTORSHIP ON AN ISSUED PATENT UNDER 37 C.F.R. 1.324(B)

Supervisory Patent Examiner – 1700
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

1. Request for Certificate of Correction

The applicant hereby petitions for a Certificate of Correction to correct the inventorship of U.S. Patent No. 6,197,181 by adding Thomas Taylor as a co-inventor with Dr. Linlin Chen. The correct inventorship should be Dr. Linlin Chen and Thomas Taylor.

2. Statement from Thomas Taylor to be Added as an Inventor

Please find enclosed a statement from Thomas Taylor in which Mr. Taylor declares that the error in failing to include him as an inventor of subject matter claimed in U.S. Patent No. 6,197,181 occurred without any deceptive intent on his part (Exhibit A).

05/28/2003 MBIZUNES 00000066 09045245
01 FC:1460 130.00 OP

3. Statement from Linlin Chen Agreeing to Correction of Inventorship

Please find enclosed a statement from Dr. Linlin Chen in which Dr. Chen states that he does not disagree to correcting the inventorship by adding Thomas Taylor as a joint inventor of subject matter claimed in U.S. Patent No. 6,197,181 (Exhibit B).

4. Statement from Assignee Agreeing to Correction of Inventorship

Please find enclosed a statement from Mr. William Freeman, an officer of the assignee of U.S. Patent No. 6,197,181, indicating that Semitool agrees to the change of inventorship in this patent (Exhibit C). Also, please find enclosed assignments from Dr. Chen and Mr. Taylor assigning their rights in U.S. Application Serial No. 10/302,701, which is a continuation of U.S. Application No. 09/045,245, to Semitool, Inc (Exhibit D).

5. U.S. Patent No. 6,197,181 Subject Matter of Pending Litigation

U.S. Patent No. 6,197,181 is the subject matter of separate lawsuits between Semitool, Inc. and each of Novellus, Inc., Applied Materials, Inc., and Ebarra, Inc. The inadvertent omission of Thomas Taylor as an inventor of subject matter claimed in the '181 Patent first came to light during a deposition in the pending lawsuits. The facts relevant to Taylor's contribution to subject matter claimed in the '181 Patent and the lack of deceptive intent in failing to name him as an inventor are set forth below.

A. Taylor Conceived and Performed Seed Layer Repair at Semitool Before the Application for the '181 Patent was Filed

In April 1997, Taylor was a team leader of Semitool's Advanced Technology Group ("ATG") and was responsible for developing new technologies for improving seed layers. (*See* Exhibit E - Taylor Dep. at 77:12 - 80:16; 120:2-22; and Exhibit F - Dep. Ex. 51.) On April 4, 1997, the ATG discussed Semitool's developments in seed layer technology. (Exhibit G - Dep. Ex. 55.) During this ATG meeting, Taylor presented information about Semitool's efforts to improve and optimize seed layers, which expressly included Taylor's ideas for using an electroless process to enhance or repair seed layers.

(Exhibit H - Dep. Ex. 56 at NOVONLY10010, NOVONLY10012; Exhibit E - Taylor Dep. at 121:20- 122:1.) The seed layers to be enhanced were ultra-thin seed layers having a thickness in the range of 200 to 500 Angstroms. (Exhibit H - Dep. Ex. 56 at NOVONLY10012; Exhibit E - Taylor Dep. at 124:25 - 125:12.) The purpose of the electroless enhancement process was to fix deficiencies, such as voids and discontinuities, in the seed layer before using an electroplating procedure to bulk fill copper into recesses. (Exhibit I - Dep. Ex. 53 at ST3081; Exhibit E - Taylor Dep. at 86:25 - 87:7; 101:2 - 102:1.)

Following the April 4 ATG meeting regarding seed layers, Taylor designed experiments to demonstrate the electroless seed layer enhancement process to Intel, which was a Semitool customer. (Exhibit I - Dep. Ex. 53 at ST3081; Exhibit E - Taylor Dep. at 99:3-24; 124:25 - 125:12.) These experiments and demonstrations of the electroless process conceived by Taylor while employed by Semitool were conducted under a confidentiality agreement between Semitool and Intel. (*See, e.g.,* Exhibit I - Dep. Ex. 53 at ST3084 identifying electroless Experiment 6 as "Semitool Confidential.") On May 1, 1997, Taylor sent a memorandum to Intel describing his "proposal to supplement the step coverage of PVD seed layers by a short electroless Cu deposition process prior to beginning electrolytic plating." (Exhibit I - Dep. Ex. 53 at ST3081.) The purpose of the experiment was to "[d]etermine if marginal PVD seed layer step coverage can be improved by supplementary electroless deposition." (*Id.* at ST3082; *see also* Exhibit J - Dep. Ex. 1053 at ST16468.) According to Taylor, the seed layers were "marginal" because they were "so thin at the bottom as to become intermittently discontinuous or so thin that the plating results were indistinguishable from having a discontinuous seed." (Exhibit E - Taylor Dep. at 101:15-19.) The following day, on May 2, 1997, Taylor presented information about the design of the electroless experiments to Semitool's ATG. (Exhibit K - Dep. Ex. 54; Exhibit E - Taylor Dep. at 112:2-24.) During May 1997, Taylor revised his electroless experiment and sent Intel further memoranda describing the experiment. (Exhibit L - Dep. Ex. 1054; Exhibit E - Taylor Dep. at

139:7 – 140:15; *see also* Exhibit M - Dep. Ex. 1056 at ST20769-70, ST20776; Exhibit E - Taylor Dep. at 140:22 – 145:21.)

By June 30, 1997, Semitool completed the experiments and prepared a report for Intel. (*See* Exhibit N - Dep. Ex. 1000.) The results of the experiment showed that the electroless process designed by Taylor was effective in eliminating voids and discontinuities in the seed layer for structures larger than approximately 0.7 microns wide. (Exhibit N - Dep. Ex. 1000 at ST3064; Exhibit E – Taylor Dep. at 136:24 - 137:23.)

LinLin Chen, the named inventor of the '181 patent, began working for Semitool on April 14, 1997. (Exhibit O - Cross Decl., ¶ 8.) Although Chen was not present at the April 4 ATG meeting, he received a copy of the June 30 report describing the results of the electroless seed enhancement experiment designed by Taylor. (*See* Exhibit N - Dep. Ex. 1000; Exhibit O - Cross Decl., ¶ 8.) Chen received a copy of this report to inform him of Semitool's current activities regarding seed layers and to "solicit [Chen's] feedback on ways that we might improve our development activities." (Exhibit E - Taylor Dep. at 30:22 - 31:5.) Moreover, at ATG meetings or in other discussions at Semitool, Taylor informed Chen of the results of the electroless experiments. (Exhibit E - Taylor Dep. at 112:25 – 114:11.) In late 1997, Chen began focusing on methods to fix deficiencies in seed layers, and on December 22, 1997, he conceived of an electrolytic seed repair process, which is the preferred embodiment of the inventions described in the '181 patent. The application for the '181 patent was filed on March 20, 1998.

B. Taylor was Inadvertently Omitted as a Co-Inventor of the '181 Patent Without Any Deceptive Intent

In mid to late 1997, a number of personnel and organizational changes occurred involving Semitool's ATG and intellectual property department. In mid 1997, Taylor left the ATG and joined Semitool's marketing department. (Exhbit E - Taylor Dep. at 13:7 – 14:2; 95:5-25.) In November, 1997, Mr. Robert Berner,

Corporate Vice President of Technology for Semitool, terminated his employment with Semitool to work for Applied Materials. (Exhibit O - Cross Decl., ¶ 11.) A few months earlier, Semitool's former intellectual property counsel left the company and Mr. Cross, currently Corporate Counsel at Semitool, joined Semitool in September 1997 as a part-time consultant working only three days a week. (Exhibit O - Cross Decl., ¶ 10.) Mr. Cross did not begin working full-time at Semitool until May 1, 1998, more than a month after the application for the '181 patent was filed. (Exhibit O - Cross Decl., ¶ 14.)

As a result of these personnel and organizational changes, Semitool inadvertently lost track of Taylor's work for using an electroless process to repair or enhance thin seed layers. (Exhibit O - Cross Decl., ¶ 14.) Only through discovery taken in this litigation, including Taylor's depositions, did Semitool realize and have an opportunity to confirm that Taylor had made an inventive contribution to the seed repair processes claimed in the '181 patent. (Exhibit O - Cross Decl., ¶ 15.) Because the omission of Taylor as a co-inventor was made without any deceptive intent, Semitool is entitled to have Taylor added as a co-inventor of the '181 patent.

5. Fee under 37 C.F.R. 1.20(b)

Enclosed is a check covering the fee of $130.00 under 37 C.F.R. § 1.20(b).

6. Additional Fees

Please charge any underpayment of fees for common consideration of this petition to Deposit Account No. 50-0665.

Respectfully submitted,

Perkins Coie LLP

Date: May 23, 2003

Paul T. Parker
Registration No. 38,264

Enclosures: Exhibits A-O

Correspondence Address:
Customer No. 25096
Perkins Coie LLP
P.O. Box 1247
Seattle, Washington 98111-1247
(206) 583-8888

Exhibit A

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants	:	Linlin Chen and Thomas Taylor
Application No. and related Patent No.	:	10/302,711 and U.S. Patent No. 6,197,181
Filed	:	November 22, 2002
For	:	APPARATUS AND METHOD FOR ELECTROLYTICALLY DEPOSITING COPPER ON A SEMICONDUCTOR WORKPIECE
	Docket No.	: 291958171US2
	Date	: November 22, 2002

Commissioner for Patents
Washington, DC 20231

STATEMENT OF THOMAS TAYLOR REGARDING JOINT INVENTORSHIP

Sir:

I, Thomas Taylor, hereby state that the error in failing to include me as an inventor of certain subject matter claimed in U.S. Patent No. 6,197,181 occurred without any deceptive intent on my part.

April 25, 2003
Date

/Thomas Taylor/
Thomas Taylor

Exhibit B

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants	:	Linlin Chen and Thomas Taylor
Application No. and related Patent No.	:	10/302,711 and U.S. Patent No. 6,197,181
Filed	:	November 22, 2002
For	:	APPARATUS AND METHOD FOR ELECTROLYTICALLY DEPOSITING COPPER ON A SEMICONDUCTOR WORKPIECE
	Docket No. :	291958171US2
	Date :	November 22, 2002

Commissioner for Patents
Washington, DC 20231

STATEMENT OF LINLIN CHEN REGARDING JOINT INVENTORSHIP

Sir:

I, Linlin Chen, hereby state that I have no disagreement in regards to the joint inventorship of me and Thomas Taylor with respect to the claimed subject matter for the above-identified application set forth in the Preliminary Amendment filed on November 22, 2002, and in certain claimed subject matter in U.S. Patent No. 6,197,181.

2/10/2003
Date

Linlin Chen

Exhibit C

Attorney Docket No. 29195.8171US00

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE PATENT APPLICATION NO.:	6,197,181
APPLICATION NO.:	09/045,245
FILED:	MARCH 20, 1998
ISSUED:	MARCH 6, 2001

FOR: **METHOD FOR ELECTROLYTICALLY DEPOSITING METAL ON A MICROELECTRONIC WORKPIECE**

Statement by Assignee Regarding Joint Inventorship and Certification Under 37 C.F.R. § 3.73(b)

Supervisory Patent Examiner - 1700
P.O. Box 1450
Alexandria, VA 22313-1450

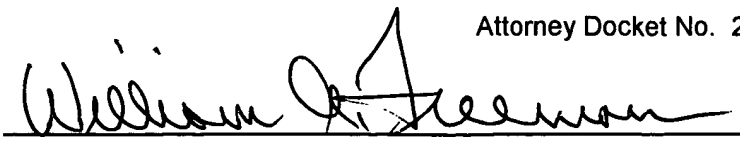
Sir:

I, the undersigned, acting on behalf of the Assignee of the entire right, title and interest in the above-identified patent, by virtue of Assignments filed by Linlin Chen and Thomas Taylor in U.S. Application No. 10/302,711, which is a continuation of U.S. Patent No. 6,197,181, hereby state that the Assignee agrees to the change in inventorship in U.S. Patent No. 6,197,181 to include Linlin Chen and Thomas Taylor.

In accordance with 37 C.F.R. § 3.73(b), I hereby certify that I am empowered to act on behalf of the Assignee. To the best of my knowledge and belief, title is in the Assignee, as evidenced by the Assignments noted above.

I further declare that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Title 18, USC § 1001 and that such willful false statements may jeopardize the validity of this application or any patent resulting therefrom.

ASSIGNEE: Semitool, Inc.

Signature: 

Typed Name: William Freeman

Title: Senior Vice President, Finance and CFO

Date:

Address: P. O. Box 7010, Kalispell, MT 59904-0010

Exhibit D

ASSIGNMENT

THIS ASSIGNMENT is by Linlin Chen and Thomas Taylor (the "Assignors"), residing at 3213 Placid Springs Lane, Plano TX 75025, and 308 SW Montgomery Street #206, Portland, OR 97201, respectively. We Assignors have invented one or more certain inventions described in a United States Patent Application entitled APPARATUS AND METHOD FOR ELECTROLYTICALLY DEPOSITING COPPER ON A SEMICONDUCTOR WORKPIECE (the "Application") and ☐ executed concurrently herewith; or ☒ filed on November 22, 2002 as Application No. 10/302,711 (the "Invention(s)"). We Assignors authorize the Assignee, identified below, or its representatives to insert the filing date and application number of the Application when known.

Semitool, Inc., a corporation of the State of Montana having a place of business at 655 West Reserve Drive, Kalispell MT 59901 ("Assignee"), desires to acquire the entire right, title and interest in and to the Invention(s) and the Application, and in and to any patents (collectively, "Patents") that may be granted for the Invention(s) in the United States or in any foreign countries.

For valuable consideration, the receipt and sufficiency of which we acknowledge, Assignors hereby sell, assign, and transfer to Assignee, its successors, legal representatives and assigns, the entire right, title and interest in and to: the Invention(s), the Application, and any Patents; any divisions, continuations, and continuations-in-part of the Application and any other application claiming priority rights from the Application; any reissues, reexaminations, or extensions of any and all Patents; the right to file foreign applications directly in the name of Assignee; and the right to claim priority rights deriving from the Application (collectively, the "Rights"). Assignors warrant that they are joint owners of the Rights, and that the Rights are unencumbered. Assignors also agree to not sign any writing or do any act conflicting with this assignment, and, without further compensation, sign all documents and do such additional acts as Assignee deems necessary or desirable to: perfect Assignee's enjoyment of the Rights; prepare and prosecute the Application or any other applications for Patents; conduct proceedings regarding the Rights, including any litigation or interference proceedings; or perfect or defend title to the Rights. Assignors request the Commissioner of Patents to issue any Patent of the United States that may be issued on the Invention(s) to Assignee. This Assignment may be executed in counterparts.

Date: 2/10/2003

Linlin Chen

STATE OF _____

COUNTY OF _____

On _____ before me personally appeared Linlin Chen, personally known to me (or proved to me on the basis of satisfactory evidence) to be the person whose name is subscribed to the within instrument and acknowledged to me that he/she executed the same in his/her authorized capacity, and that by his/her signature on the instrument the person, or the entity upon behalf of which the person acted, executed the instrument.

WITNESS my hand and official seal.

(Seal)

_____
Signature

* * * * * * * *

Date: _____

_____
Thomas Taylor

STATE OF _____

COUNTY OF _____

On _____ before me personally appeared Thomas Taylor, personally known to me (or proved to me on the basis of satisfactory evidence) to be the person whose name is subscribed to the within instrument and acknowledged to me that he/she executed the same in his/her authorized capacity, and that by his/her signature on the instrument the person, or the entity upon behalf of which the person acted, executed the instrument.

WITNESS my hand and official seal.

(Seal)

_____
Signature

* * * * * * * *

ASSIGNMENT

THIS ASSIGNMENT is by Linlin Chen and Thomas Taylor (the "Assignors"), residing at 3213 Placid Springs Lane, Plano TX 75025, and 308 SW Montgomery Street #206, Portland, OR 97201, respectively. We Assignors have invented one or more certain inventions described in a United States Patent Application entitled APPARATUS AND METHOD FOR ELECTROLYTICALLY DEPOSITING COPPER ON A SEMICONDUCTOR WORKPIECE (the "Application") and ☐ executed concurrently herewith; or ☒ filed on November 22, 2002 as Application No. 10/302,711 (the "Invention(s)"). We Assignors authorize the Assignee, identified below, or its representatives to insert the filing date and application number of the Application when known.

Semitool, Inc., a corporation of the State of Montana having a place of business at 655 West Reserve Drive, Kalispell MT 59901 ("Assignee"), desires to acquire the entire right, title and interest in and to the Invention(s) and the Application, and in and to any patents (collectively, "Patents") that may be granted for the Invention(s) in the United States or in any foreign countries.

For valuable consideration, the receipt and sufficiency of which we acknowledge, Assignors hereby sell, assign, and transfer to Assignee, its successors, legal representatives and assigns, the entire right, title and interest in and to: the Invention(s), the Application, and any Patents; any divisions, continuations, and continuations-in-part of the Application and any other application claiming priority rights from the Application; any reissues, reexaminations, or extensions of any and all Patents; the right to file foreign applications directly in the name of Assignee; and the right to claim priority rights deriving from the Application (collectively, the "Rights"). Assignors warrant that they are joint owners of the Rights, and that the Rights are unencumbered. Assignors also agree to not sign any writing or do any act conflicting with this assignment, and, without further compensation, sign all documents and do such additional acts as Assignee deems necessary or desirable to: perfect Assignee's enjoyment of the Rights; prepare and prosecute the Application or any other applications for Patents; conduct proceedings regarding the Rights, including any litigation or interference proceedings; or perfect or defend title to the Rights. Assignors request the Commissioner of Patents to issue any Patent of the United States that may be issued on the Invention(s) to Assignee. This Assignment may be executed in counterparts.

Date:_____ _____
Linlin Chen

STATE OF _____

COUNTY OF _____

On _____ before me personally appeared Linlin Chen, personally known to me (or proved to me on the basis of satisfactory evidence) to be the person whose name is subscribed to the within instrument and acknowledged to me that he/she executed the same in his/her authorized capacity, and that by his/her signature on the instrument the person, or the entity upon behalf of which the person acted, executed the instrument.

WITNESS my hand and official seal.

(Seal) _____
Signature

* * * * * * * *

Date: April 25, 2003 _____
Thomas Taylor

STATE OF Massachusetts

COUNTY OF Middlesex

On April 25, 2003 before me personally appeared Thomas Taylor, personally known to me (or proved to me on the basis of satisfactory evidence) to be the person whose name is subscribed to the within instrument and acknowledged to me that he/she executed the same in his/her authorized capacity, and that by his/her signature on the instrument the person, or the entity upon behalf of which the person acted, executed the instrument.

WITNESS my hand and official seal.

(Seal) M. Frank Rizzello
Signature
Expires June 12, 2009

* * * * * * * *

Exhibit E

CONDENSED TRANSCRIPT

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF OREGON

SEMITOOL, INC.,
Plaintiff,

vs.

No. 16-01-06060

NOVELLUS SYSTEMS, INC.,
Defendant.

HIGHLY CONFIDENTIAL

VIDEOTAPED DEPOSITION OF

THOMAS TAYLOR

VOLUME II

October 23, 2002
9:15 a.m.

6011 SW Second Avenue
Suite 1600
Portland, Oregon

Carol Ann Nevarez, Certified Shorthand Reporter for Oregon

Alexander Gallo Associates, Inc.
COURT REPORTING VIDEO SERVICES

• ATLANTA'S TECHNOLOGICAL LEADERS IN LITIGATION SUPPORT •

ATLANTA, GEORGIA WASHINGTON, DC CHICAGO, ILLINOIS NEW YORK, NEW YORK

Telephone (404) 495-0777
Facsimile (404) 495-0766
Toll Free (877) 495-0777

Complimentary Conference Rooms
Throughout Georgia And
Major Cities Nationwide

500 The Candler Building
127 Peachtree Street
Atlanta, Georgia 30303

www.galloreporting.com

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF OREGON

SEMITOOL, INC., Plaintiff, vs. APPLIED MATERIALS, INC., Defendant.	No. 01-CV-1066-BR
SEMITOOL, INC., Plaintiff, vs. EBARA CORPORATION and EBARA TECHNOLOGIES, INC., Defendants.	No. 01-CV-873-BR
SEMITOOL, INC., Plaintiff, vs. NOVELLUS SYSTEMS, INC., Defendant.	No. 01-CV-874-BR ****CONTAINS**** HIGHLY CONFIDENTIAL ***INFORMATION***

HIGHLY CONFIDENTIAL

VIDEOTAPED DEPOSITION OF THOMAS TAYLOR

Taken in behalf of Defendant Novellus Systems, Inc.

March 25, 2002

Portland, Oregon

BE IT REMEMBERED that the videotaped deposition of THOMAS TAYLOR was taken in behalf of Defendant Novellus Systems, Inc., pursuant to the Federal Rules of Civil Procedure, before Bonita J. Alexander, Certified Shorthand Reporter for Oregon, on Monday, the 25th day of March, 2002, in the law offices of Perkins Coie LLP, 1211 S.W. Fifth Avenue, Suite 1500, Portland, Oregon, commencing at the hour of 9:50 a.m.

APPEARANCES

PERKINS COIE LLP
By: Mr. Jerry A. Riedinger and Mr. Paul T. Fortino, appearing in behalf of the Plaintiff;

WEIL, GOTSHAL & MANGES LLP
By: Mr. Jared Bobrow, appearing in behalf of Defendant Applied Materials, Inc.;

FISH & NEAVE
By: Mr. Terrence J.P. Kearney, appearing in behalf of Defendant Ebara Corporation;

IRELL & MANELLA LLP
By: Mr. Roman Melnik, appearing in behalf of Defendant Novellus Systems, Inc.

SEMITOOL, INC.
By: Mr. Harry Cross, In-House Counsel.

ALSO PRESENT
William Thoma, Limelight Video Productions

INDEX

DEPOSITION OF THOMAS TAYLOR

--oOo--
*** NO EXHIBITS MARKED ***
--oOo--

THE VIDEOGRAPHER: This is Volume 1, tape 1 in the deposition of Tom Taylor, in the matter of Semitool vs. Novellus Systems, Case No. 01-CV-874-BR; also Semitool vs. Applied Materials, 01-CV-1066-BR; and also Semitool vs. Ebara Technologies, Inc., 01-CV-873-BR. 09:50:14 09:50:16 09:50:18 09:50:21 09:50:27 09:50:34

Today's date is March 25th, 2002. The time on the video monitor is 9:50 a.m. The video operator today is William Thoma, contracted by Legalink Los Angeles, at 16830 Ventura Boulevard, Encino, California. 09:50:41 09:50:45 09:50:50 09:50:53 09:50:58

This video deposition is taking place at Perkins Coie, 1211 Southwest Fifth, Portland, Oregon, and was noticed by Roman Melnik of Irell & Manella. 09:51:00 09:51:02 09:51:06 09:51:09

Counsel, please voice identify yourselves and state whom you represent. 09:51:11 09:51:13

MR. MELNIK: Roman Melnik of Irell for Novellus Systems. 09:51:15 09:51:18

MR. BOBROW: Jared Bobrow of Weil, Gotshal for Applied Materials. 09:51:19 09:51:20

MR. KEARNEY: Terry Kearney of Fish & Neave, for Ebara Corporation. 09:51:23 09:51:25

MR. RIEDINGER: Jerry Riedinger from Perkins Coie for Semitool. And also with me is 09:51:27 09:51:28

1984, at the time that I got my degree, if you 09:56:25
recall, and went to work for an organization called 09:56:29
FSI for a very short period of time, six months, was 09:56:34
recruited away to Sperry, in Eagan, Minnesota, as a 09:56:38
process development engineer. 09:56:44
Sperry was acquired by Burroughs. I went 09:56:49
to Cray Research in Chippewa Falls, Wisconsin from 09:56:53
1986, roughly, to 1989. 09:57:00
In 1989 I took a position with a company 09:57:06
called Ramtron International Corporation. 09:57:09
You smile. 09:57:13
Q. No, I'm only smiling because you have a 09:57:13
rather long employment -- unusually long employment 09:57:17
history. 09:57:20
A. It has been 24 years, but you're right, 09:57:21
there are a number. 09:57:23
Q. Please go ahead. 09:57:24
A. At Ramtron my position was to lead a team 09:57:25
developing a specialty DRAM fabrication technology 09:57:28
for a company called NMBS Semiconductor in Tateyama, 09:57:34
Japan. That was an 18-month stint. 09:57:40
At the conclusion of that, I went to work 09:57:43
for Ramtron in Colorado Springs for -- until 1996. 09:57:45
In the spring of 1996, took the position with 09:57:58
Semitool in Kalispell, Montana, was there until the 09:58:01

spring of 1999, at which time I went to work for 09:58:04
Rohm & Hass Company and its subsidiaries, Shipley 09:58:11
and Rodel. 09:58:15
Q. Now, do you remember exactly when in 1996 09:58:16
you joined Semitool? 09:58:21
A. I do recall -- I'm sorry, I could have 09:58:23
brought that, but it was the autumn of 1996. 09:58:26
Q. Autumn of 1996. And do you remember 09:58:28
exactly when during the autumn of 1996? 09:58:31
A. I'm sorry, I don't remember precisely, 09:58:34
exactly what month it was. 09:58:37
Q. Do you remember early versus late autumn? 09:58:39
A. I remember that there was frost on the 09:58:41
pumpkins. I was in my temporary -- this was perhaps 09:58:45
summertime, late summer as opposed to fall, but that 09:58:51
was approximately when it was. 09:58:54
Q. Late summer-early fall? 09:58:57
A. Yeah. 09:58:59
Q. Or possibly a little later? 09:58:59
A. (Witness nods head.) 09:59:01
Q. And do you remember exactly when you left 09:59:01
Semitool? 09:59:09
A. My recollection is the end of -- beginning 09:59:09
of April of 1999. 09:59:12
Q. I think you described this a little bit 09:59:22

already, but just -- I was taking notes and perhaps 09:59:23
I wasn't listening as carefully as I should have 09:59:26
been. Can you describe in a little more detail your 09:59:28
work at Ramtron for me. 09:59:31
A. At Ramtron I started as the manager of 09:59:33
process development, took a role after approximately 09:59:36
two years as the director of technology alliances, 09:59:44
and held that position until I departed. This is in 09:59:47
Colorado Springs, of course. 09:59:51
Q. And as director of technology alliances, 09:59:55
was that primarily an R and D job or primarily a 09:59:58
marketing-type job? 10:00:02
A. It was an add mixture of the two. It was 10:00:03
a role in which I was responsible for developing 10:00:06
contractual arrangements between Ramtron and 10:00:13
large-scale manufacturers for the transfer of 10:00:16
Ramtron's proprietary ferroelectric memory 10:00:19
technology, which required a fairly in-depth 10:00:24
knowledge as to the details of that technology and 10:00:26
how it might be implemented in the CMOS baseline 10:00:28
structures of a variety of partners. And it also, 10:00:35
of course, required a certain amount of technical 10:00:38
marketing as well. 10:00:40
Q. Did your responsibilities at Ramtron 10:00:46
relate in any way to electroplating or electroless 10:00:50

deposition? 10:00:57
A. None. 10:00:57
Q. I'm sorry, was the answer "none"? 10:00:59
A. The answer was none. The answer was that 10:01:00
none of those responsibilities related to 10:01:04
electroplating or electroless technology. 10:01:07
Q. When you started at Semitool, whatever the 10:01:18
time frame was, early fall of 1996, do you recall 10:01:22
what your first job responsibility was? 10:01:29
A. At? 10:01:32
Q. Semitool. 10:01:34
A. Yes. My responsibilities were as the 10:01:36
process development manager, and I was tasked with 10:01:38
overseeing the activities of a group of process 10:01:44
development engineers working in both electroplating 10:01:48
and in single-substrate wet chemical processing, 10:01:51
cleaning solvent and acid cleaning and so forth, 10:01:55
etching. 10:01:58
Q. And for how long did you remain process 10:02:18
development manager at Semitool? 10:02:20
A. For approximately nine months, and -- 10:02:22
well, approximately nine months. 10:02:27
Q. And when did you change positions, and 10:02:28
what was your next position? 10:02:33
A. Approximately nine months after I arrived, 10:02:34

Mr. Paul Fortino from Perkins Coie, and Mr. Harry Cross, corporate counsel for Semitool. 09:51:32 09:51:35

THE VIDEOGRAPHER: The court reporter is Bonita Alexander of Beovich Walter & Friend. 09:51:38 09:51:39

Would the court reporter please swear in the witness. 09:51:42 09:51:43

09:51:44

THOMAS TAYLOR

called as a witness in behalf of Defendant Novellus Systems, Inc., being first duly sworn, is examined and testifies as follows:

EXAMINATION

BY MR. MELNIK: 09:51:52

Q. Mr. Taylor, would you please state your full name and address for the record, please. 09:51:53 09:51:55

A. My name is Thomas Charles Taylor. My address is 0308 Southwest Montgomery, Apartment No. 206, Portland, Oregon. 09:51:57 09:51:59 09:52:04

Q. Mr. Taylor, are you being represented by a lawyer in today's deposition? 09:52:07 09:52:11

A. No. I'm here without the benefit of counsel. 09:52:12 09:52:14

Q. You have -- do you understand that you have the right to bring a lawyer to the deposition? 09:52:16 09:52:16

A. I do. 09:52:20

Q. And you would like to proceed without a lawyer? 09:52:21 09:52:23

A. I would. 09:52:23

Q. At some point prior to today's deposition, were you contacted by the Perkins Coie law firm about representing you at this deposition? 09:52:23 09:52:31 09:52:35

A. Perkins Coie offered to represent me, as did, in fact, the attorneys for Shipley Company, with whom I was employed following my tenure at Semitool. 09:52:37 09:52:42 09:52:45 09:52:49

Q. And what was your response? 09:52:50

A. At the time I appreciated the offer, did not make a commitment, and chose effectively about two weeks ago to proceed without official representation. 09:52:50 09:52:54 09:52:58 09:53:01

Q. Mr. Taylor, can you please tell me about your educational background, beginning with college, please. 09:53:01 09:53:14 09:53:20

A. Certainly. I graduated from the University of Utah in 1984 with a baccalaureate in chemical engineering, a bachelor of science in chemical engineering, proceeded in 1989 to pursue a master's in materials science at the University of Minnesota while employed at Cray Research, chose to 09:53:20 09:53:22 09:53:27 09:53:31 09:53:35 09:53:37

take a position working in Japan prior to completing thesis work, so that was incomplete. 09:53:42 09:53:45

I'm currently in the Ph.D. program at Portland State University, in the discipline called systems science. 09:53:46 09:53:49 09:53:52

Q. Since you didn't have a lawyer, who told you about -- Let me ask this. Is this your first deposition? 09:53:54 09:54:05 09:54:07

A. First ever. 09:54:07

Q. I guess I should give you a little bit of background on how these things work. You notice to the left there's a court reporter who is taking down what you and I are saying, and there's also a videographer over there videotaping you. The most important part of this is because we're doing a written transcript, it's important not to do what normal people do, which is to nod and make nonverbal -- and give nonverbal answers. It's important to say yes or no, rather than huh-uh, uh-huh, or something like that. 09:54:08 09:54:11 09:54:13 09:54:15 09:54:18 09:54:22 09:54:24 09:54:28 09:54:32 09:54:35 09:54:38

A. If you catch me, please correct me. 09:54:40

Q. I will try. And vice versa. I do it, too. 09:54:42 09:54:45

Also, it's important so that we can all go home at a reasonable hour, including most importantly you, that you listen carefully to the questions that I ask and answer those questions so that I don't have to repeat my questions several times, because the way people normally speak to each other is they listen to the context of the question and respond to the context. Lawyers frequently, not being people, don't pose questions that way, they tend to pose questions in a very particular narrow way, and it's important to listen to the exact questions being asked before you answer. 09:54:46 09:54:51 09:54:53 09:54:55 09:55:02 09:55:04 09:55:08 09:55:10 09:55:14 09:55:18 09:55:21 09:55:23

A. I understand. 09:55:24

Q. Okay. So can you please tell me now your employment history, starting with your first job and going up to your time at Shipley. 09:55:24 09:55:36 09:55:42

A. Yes. The first job -- the first job in this industry was in 1977, at Motorola, what was at that time called NMOS, prior to the formation of their silicon product sector. 09:55:44 09:55:50 09:55:57 09:55:59

Following that, worked for six years at National Semiconductor in Salt Lake City in both engineering and production management roles. 09:56:01 09:56:06 09:56:13

Q. When did you leave Motorola? 09:56:16

A. 19 -- late 1978. 09:56:17

Q. Go ahead, please. 09:56:20

A. I was at National Semiconductor through 09:56:22

transcript confidential. 10:09:09
A. Confidential to whom? 10:09:10
Q. In other words, none of us can tell our 10:09:12
clients. Only the lawyers would know. There's a 10:09:18
court order in place. 10:09:20
A. That involves Intel confidential 10:09:22
information? 10:09:25
Q. Anybody's confidential information that 10:09:25
would be listed in this lawsuit pursuant -- as part 10:09:27
of discovery or subpoenas. So, you have to answer 10:09:30
the question, but I think with all the other 10:09:34
lawyers' agreement, we'll just designate that 10:09:37
portion highly confidential. 10:09:41
A. Anything that involves Intel or any other 10:09:42
customer who's not a party to this suit, then I'd 10:09:46
ask that to be the case. 10:09:48
Q. Yes, we will designate that highly 10:09:49
confidential. 10:09:52
MR. MELNIK: I wonder if for this portion, 10:09:53
Mr. Cross, if it's going to be highly 10:09:55
confidential -- 10:09:57
MR. RIEDINGER: Well, the question that 10:09:57
precedes it is whether this was information that was 10:09:58
already in the possession of Semitool. There's not 10:10:01
reason for Mr. Cross to leave if this was 10:10:05

information that was Intel information provided. 10:10:05
MR. MELNIK: That's a fair point. 10:10:06
BY MR. MELNIK: (continuing) 10:10:08
Q. You knew this information at the time you 10:10:08
were at Semitool, the information you're about to 10:10:10
tell us? 10:10:12
A. I'm sorry, you're going to have to restate 10:10:13
your question. 10:10:16
Q. I'm sorry. Okay. The Intel confidential 10:10:17
information that you're concerned about, is this 10:10:21
information you knew at the time you were a Semitool 10:10:24
employee? 10:10:27
A. That is going to depend on the specifics 10:10:27
of the question. 10:10:30
Q. Okay. To the extent that it was 10:10:33
information that you knew when you were a Semitool 10:10:35
employee, I agree that Mr. Cross does not have to 10:10:38
leave. If you're going to tell us something that is 10:10:40
Intel confidential information that you didn't know 10:10:43
at the time you were at Semitool -- 10:10:48
A. I wouldn't. 10:10:50
Q. Okay. Well, let's cross that bridge when 10:10:51
we come to it. 10:10:56
A. Fair enough. 10:10:57
Q. Okay. Now, we'll designate this portion 10:10:58

of the transcript highly confidential. 10:11:03
A. Thank you. 10:11:07
Q. I can't tell Novellus, Mr. Bobrow can't 10:11:07
tell Applied and so on. 10:11:09
A. Understood. 10:11:11
MR. RIEDINGER: Well, to be fair, the 10:11:12
protective order does allow certain consultants 10:11:13
hired for the litigation, once they've agreed to 10:11:16
comply with the terms of the protective order, to 10:11:19
get access as well. 10:11:21
THE WITNESS: I understand that as well. 10:11:23
MR. MELNIK: I didn't mean to modify the 10:11:24
protective order. I was just trying to summarize. 10:11:26
BY MR. MELNIK: (continuing) 10:11:28
Q. Now, let's see if you can answer the 10:11:28
question. 10:11:30
A. Restate the question, please. 10:11:30
Q. Okay, sorry. 10:11:33
Was the idea essentially that Intel would 10:11:34
give Semitool the wafers, and in exchange, Semitool 10:11:37
would share with Intel the results of the 10:11:42
experiments? 10:11:44
MR. RIEDINGER: Since we're moving into 10:11:45
substantive stuff, I will start interposing 10:11:47
objections to leading questions. And so on this one 10:11:49

I do object to the form of the question as leading. 10:11:51
BY MR. MELNIK: (continuing) 10:11:55
Q. Okay. Since you haven't been prepared, I 10:11:56
guess I should tell you how this works. You still 10:11:57
have to answer my question, but after Mr. Riedinger 10:12:00
makes his objection. 10:12:03
A. Fine. 10:12:05
The idea was that we would demonstrate the 10:12:05
efficacy of an electroplating process on Intel's 10:12:09
wafers with and without the use of an electroless 10:12:12
deposition preceding the bulk deposition of copper. 10:12:16
Q. And share those results with Intel? 10:12:22
A. Absolutely. 10:12:24
Q. Do you recall if at the time you 10:12:35
characterized these experiments as evaluating 10:12:39
electroless enhancement of marginal PVD seed layers? 10:12:45
A. Yes, I recall that. In fact, that was the 10:12:50
principal reason for evaluating an electroless 10:12:55
process, was the feeling that the seed layer that 10:12:59
Intel was providing was, in fact, marginal and 10:13:04
incapable of being filled with an electroplating 10:13:07
process alone. 10:13:10
Q. And what did you mean by marginal in that 10:13:11
time frame? 10:13:16
A. Discontinuous, not continuously 10:13:16

I took a position as the director of marketing for what was at the time the ECD division. 10:02:38 10:02:43

Q. I'm wondering if we can now triangulate your start date based on the date in which you changed positions and subtracting nine months. Thinking about it now, does that help you remember when you started? 10:02:51 10:02:54 10:02:56 10:03:00 10:03:02

A. No, it doesn't. 10:03:03

Q. You just remember it was a nine-month delta? 10:03:03 10:03:08

A. Yes, approximately a nine-month delta. 10:03:08

Q. And what were your responsibilities as director of marketing? 10:03:24 10:03:25

A. To develop collateral demonstrating the utility of Semitool's approach to electroplating copper, to build on the early infrastructure, I guess, that existed, the early system placements that Semitool enjoyed, to particularly, though, to focus on the introduction of a new tool architecture that replaced what was an earlier sort of derivative design from other single-substrate processing applications. Customer presentations featured very importantly. 10:03:26 10:03:29 10:03:33 10:03:40 10:03:46 10:03:49 10:03:54 10:03:58 10:04:00 10:04:11

Q. Was there a name for this new tool architecture you mentioned? 10:04:14 10:04:16

A. The tool that was introduced to the market was -- the name under which it was introduced was LT210. 10:04:17 10:04:19 10:04:23

Q. And I'm sorry, you said that the focus of your work with the LT210 was in electroplating copper, or did I misunderstand? 10:04:31 10:04:33 10:04:38

A. No, you didn't. The earlier tools had broad applications, electroplating being one of them. The LT210 was specifically focused as a electroplating system. It ultimately gave rise to other applications, but its principal application upon design and introduction was for electroplating. 10:04:40 10:04:43 10:04:45 10:04:49 10:04:52 10:04:54

Q. And do you remember when it was introduced? 10:04:58 10:05:00

A. The dates, no, I do not. 10:05:00

Q. Do you remember the rough time period? 10:05:01

A. Roughly in mid 1997. Roughly Semicon West time frame. 10:05:05 10:05:14

Q. And do you remember, did its functionality change drastically over the next year or so or did the LT210 stay pretty much the same? 10:05:24 10:05:29 10:05:33

A. There were a number of enhancements, but if we're talking about its fundamental purpose to electroplate copper on semiconductor devices, then it remained the same. 10:05:36 10:05:38 10:05:41 10:05:44

Q. Do you remember doing a demo or a number of demos called Experiment 5 and Experiment 6 for Intel in the May-June 1997 time frame? 10:05:45 10:06:09 10:06:14

A. I remember that. 10:06:16

Q. Whose suggestion was it to do that work for Intel? Did the suggestion come from Intel or from you? 10:06:18 10:06:30 10:06:34

A. My recollection is that it was developed as a consequence of dialogue, but whether it came specifically from an Intel employee or from a Semitool employee, I do not recall. 10:06:35 10:06:39 10:06:43 10:06:47

Q. Do you remember a similar set of experiments being run in the same time frame for Leti? 10:07:04 10:07:05 10:07:09

MR. RIEDINGER: I'm sorry. 10:07:10

MR. MELNIK: Leti, L-E-T-I. I won't try to sound out the French name. 10:07:11 10:07:15

THE WITNESS: I do not recall the details. That is -- it sounds familiar, but I am not recalling the details of that as clearly as I am for the work done for domestic potential customers. 10:07:17 10:07:20 10:07:23 10:07:26

BY MR. MELNIK: (continuing) 10:07:31

Q. Do you remember where the wafers came from on which Experiment 5 and Experiment 6 for Intel were done? 10:07:40 10:07:43 10:07:46

A. Where the wafers came from? Process development experimentation frequently employs wafers from a variety of sources. Feasibility studies, as an example, often employ very inexpensive, readily available, internally fabricated structures. Others that are done specifically to demonstrate compatibility with a customer's structures come from customers. My recollection is that the Intel demos were of that nature. 10:07:46 10:07:58 10:08:00 10:08:03 10:08:07 10:08:10 10:08:14 10:08:16 10:08:19 10:08:23

Q. That the wafers were given to Semitool by Intel? 10:08:24 10:08:28

A. That a fraction of the wafers were given to Semitool by Intel. 10:08:28 10:08:30

Q. And was the idea basically that Intel would give Semitool the wafers, and then in exchange Semitool would share with Intel the results of the experiments? 10:08:38 10:08:41 10:08:44 10:08:47

A. I don't believe that I am at liberty to discuss Intel's expectations or even their preparations and instructions with respect to customer demos of Semitool. 10:08:47 10:08:50 10:08:54 10:08:56

Q. Let me see if we can try this. To the extent that you remember them, you have to tell us, although we will designate that portion of the 10:08:59 10:09:02 10:09:06

at least in some cases the ability to deposit on top of a preexisting seed layer. But their principal focus was either to deposit the copper in full thickness by electroless technology or, absent that, depositing the seed layer itself by electroless technology, absent the requirement of doing a PVD copper deposition.

Q. And the process sequence where one deposits the electroless copper on top of a PVD or CVD seed prior to a fill step, is that sometimes called seed repair or seed enhancement?

A. Yes, it's been referred to that way.

Q. Do you recall if the papers you saw from Leti or from IMEC, did those papers deal with copper?

A. Those papers were specifically related to copper. That was one of the criteria for the search, if I recall correctly.

Q. You might have said this before, but I missed it, so I apologize. Do you remember when you did this search? I know you said it was at Semitool, but –

A. It was at Semitool, and it was prior to doing the demonstrations for Intel.

Q. Let me show you what has previously been

marked in this case as Exhibit 1000. I'll just write "Exhibit 1000" in the corner.

MR. RIEDINGER: Is that a copy of the same document that was previously marked as 1000?

MR. MELNIK: Yes. It just doesn't have the court reporter's stamp on it.

MR. RIEDINGER: Thank you.

BY MR. MELNIK: (continuing)

Q. And if you could take a look at this document and see if you remember it.

A. Yes.

Q. Yes, you do remember it?

A. Yes, I remember this.

Q. Was this sort of the final summary report for the work for Intel that we've just been discussing?

MR. RIEDINGER: Objection, leading.

THE WITNESS: I don't recall that this was the final summary report. This could have been. The way that this is written, I would tend to characterize this as an interim document.

BY MR. MELNIK: (continuing)

Q. It was a report relating to the electroless seed layer enhancement work that we've been discussing?

A. Prima facie, "Subject: Seed layer enhancement through electroless plating," yes.

Q. Fair enough.

Who, other than – Well, let me back up. You participated – you were one of the people who participated in the design of this experiment?

A. Yes.

Q. Who other than yourself participated in the design of this experiment?

A. My recollection is that the individuals that are noted here on the copy list: Henry Stevens, Jeff Turner, Linlin Chen, also Tom Ritzdorf. I do not Bob Berner having been involved in substantive discussions on this topic. Shu Jin of Intel, Chun Mu of Intel were also involved.

Chun Mu and I had independent or individual discussions one on one on this topic outside of the group discussions.

Q. What was Henry Stevens' role?

A. Henry was – Henry Stevens was acting as, at the time, a consultant. He, I believe, although that would have to go back to Semitool's records, I believe that we ultimately brought him on board as a full-time employee, but for some period of time my again recollection is that especially during 1997,

he was working as a consultant on process development.

Q. And specifically with respect to this experiment, what was his role in terms of designing this experiment?

A. I don't recall his specific input.

Q. What about Jeff Turner? Do you recall anything specific that he did with respect to this experiment?

A. Jeff's role was not necessarily conceptualizing the approach, but managing Matt Johnson's implementation of it. Jeff was functioning as the principal engineer, laboratory manager. He oversaw the utilization of the equipment, made sure that tool time availability and system configuration was such that we could get experiments done in a logical sequence.

Q. And I gather from your last answer that Matt Johnson is the person that actually did the experiment?

A. That's again my recollection, and it was consistent with our approach at the time, in that the engineer who conducted the experiment would be the one who summarized the results.

Q. And with respect to, I guess, should that

electrically conductive through its entire 10:13:20
cross-section. 10:13:24
Q. And do you mean, to the extent that you do 10:13:37
remember, that the CVD seed that Leti was providing, 10:13:39
do you remember if that was also discontinuous in 10:13:43
the same way? 10:13:46
A. I do not, in that Leti was performing 10:13:47
independent experimentation on electroless processes 10:13:54
and may have had an interest in the technology aside 10:13:57
from its ability to heal or improve seed layers. 10:13:59
Q. And when you say that Leti was performing 10:14:06
independent experiments in electroless technology, 10:14:08
do you mean that they were doing electroless seed 10:14:12
repair or electroless fill? 10:14:14
A. I don't know the scope of their 10:14:17
activities, but I seem to recall papers that have 10:14:18
been published and in the public domain that 10:14:21
indicated that they were evaluating both options. 10:14:24
Q. Do you remember who the authors were or 10:14:29
where you might have seen the papers? 10:14:30
A. I do not know exactly who the authors 10:14:32
were. I do know the authors -- this is not a 10:14:34
question you've asked, so I'll wait until you do. 10:14:37
Q. Okay. Do you know who the authors were? 10:14:40
A. No. 10:14:42

Q. Do you know where you saw the papers? 10:14:43
A. During a period of literature searching 10:14:46
while I was employed at Semitool, because I was at 10:14:50
the time unfamiliar with the details of electroless 10:14:53
technology, and it was part of an attempt to come up 10:14:57
to speed. 10:15:02
Q. I'm sorry, I guess that was an ambiguous 10:15:02
question. When I asked where, I really meant what 10:15:05
journal or conference proceeding. 10:15:07
A. Not off the top of my head, no. No, I do 10:15:09
not. 10:15:11
Q. Do you have copies of those papers? 10:15:11
A. No, I do not. 10:15:13
Q. Is there anything else that you could tell 10:15:14
me that would help me locate those papers? 10:15:16
A. Only that my recollection is that they 10:15:17
were published in the 1995-1996 time frame. I 10:15:22
believe that they were published in European as 10:15:30
opposed to U.S. journals, or perhaps in conference 10:15:34
proceedings. That's the extent of it. To the best 10:15:37
of my recollection, those are papers that remained 10:15:44
at Semitool when I departed, to the best of my 10:15:50
recollection. 10:15:56
Q. Oh, so you had copies of those papers and 10:15:56
you left them at Semitool when you left? 10:16:00

A. Along with all my other documentation. 10:16:00
Q. And just so that we close the circle on 10:16:03
this, your best recollection is that the authors of 10:16:07
the papers were researchers of Leti Grenoble? 10:16:09
MR. RIEDINGER: Objection, leading. 10:16:15
THE WITNESS: My best recollection is that 10:16:17
there were papers that were published by Leti. I do 10:16:19
not know Leti Gressi's (phonetic) actual location. 10:16:22
I do not know if it was in Grenoble, their Grenoble 10:16:28
facility. 10:16:32
I guess I will supplement this by saying 10:16:33
at the same time I ran across papers by a gentleman 10:16:35
named Dr. Roger Palmans of IMEC, and it is 10:16:39
conceivable that I am getting the two mixed up in my 10:16:43
mind, but I do recall, I believe, that there were 10:16:46
papers both by Leti and by IMAC. 10:16:48
BY MR. MELNIK: (continuing) 10:16:51
Q. Can you spell Dr. Palmans' last name? 10:16:51
A. P-a-l-m-a-n-s. 10:16:54
Q. And IMEC is I-M-E-C? 10:16:59
A. Correct. 10:17:02
Q. And what does IMEC stand for, do you know? 10:17:03
A. It is Belgian, and it basically stands for 10:17:04
the Institute of Microelectronic Research, but it is 10:17:08
in Flemish or something. 10:17:11

Q. And your recollection is that one or both 10:17:16
of these sets of papers described electroless seed 10:17:19
repair and electroless fill? 10:17:23
MR. RIEDINGER: Objection, leading. Lacks 10:17:25
foundation. 10:17:27
THE WITNESS: My recollection is that they 10:17:29
concentrated on electroless fill, highlighted some 10:17:31
of the drawbacks, and as supplementary comments 10:17:34
indicated that, nonetheless, despite filling 10:17:38
appeared to have its challenges, that the technology 10:17:43
could be employed for depositing a seed layer, not 10:17:47
necessarily as a seed layer repair, but to deposit a 10:17:51
seed layer. 10:17:55
BY MR. MELNIK: (continuing) 10:17:55
Q. And when you say "deposit a seed layer," 10:18:00
do you mean on top of a discontinuous PVD/CVD seed 10:18:03
or do you mean on top of a barrier? 10:18:08
A. Both. 10:18:10
MR. RIEDINGER: Compound question. 10:18:11
BY MR. MELNIK: (continuing) 10:18:12
Q. I'm sorry, your answer was both? 10:18:12
A. Principal focus was the ability to deposit 10:18:13
a seed layer on a barrier, though there were, my 10:18:17
recollection -- and remember this is several years 10:18:20
old, my recollection is that they had also evaluated 10:18:22

be in some cases mutually binding. 10:32:07
BY MR. MELNIK: (continuing) 10:32:14
Q. During 1997, were you a member of the ATG group? 10:32:15 10:32:23
A. Advanced technology group, of course. 10:32:23
Q. Advanced technology group. 10:32:26
And was Dr. Chen also a member? 10:32:29
A. Yes. 10:32:32
Q. When you did the literature search that we were discussing and you located the Letl and the IMEC papers, did you give copies of those papers to other members of the advanced technology group? 10:32:33 10:32:40 10:32:45 10:32:51
A. I don't remember exactly how the information was disseminated. I am sure that I discussed it and the contents with Tom Ritzdorf. I do not recall whether any of these other individuals were explicitly copied. 10:32:53 10:32:55 10:32:58 10:33:03 10:33:05
Q. Do you remember if you wrote any memos about these papers or did you just discuss them orally with Mr. Ritzdorf? 10:33:11 10:33:13 10:33:17
A. I don't recall – 10:33:18
MR. RIEDINGER: Objection to the form of the – 10:33:19 10:33:20
THE WITNESS: I'm sorry, please go ahead. 10:33:21
MR. RIEDINGER: You need to give me just a 10:33:23

short time to get the objection in. 10:33:25
THE WITNESS: I apologize. 10:33:27
MR. BOBROW: I couldn't hear the answer. 10:33:27
MR. MELNIK: Yeah, I couldn't either. 10:33:27
(The record is read, as requested.) 10:33:33
BY MR. MELNIK: (continuing) 10:33:39
Q. Maybe you could repeat your answer. 10:33:40
A. Would you repeat the question, please. 10:33:42
Q. Sure. 10:33:44
The question was whether in discussing these papers with at least Mr. Ritzdorf, whether that discussion was oral or whether you wrote him one or more memos. 10:33:45 10:33:47 10:33:50 10:33:53
A. I don't recall. 10:33:55
Q. What helps you remember that you discussed the results of the literature search with Tom Ritzdorf specifically? 10:34:06 10:34:09 10:34:11
A. Principally because Tom Ritzdorf and I discussed mutual discoveries or learning, "discoveries" meaning findings of prior art or our own thinking on topics with respect to chemistry development in particular, to the best of my knowledge, across the board, every time. Tom Ritzdorf was unquestionably the individual that I relied upon most from the standpoint of a technical 10:34:13 10:34:16 10:34:23 10:34:26 10:34:34 10:34:40 10:34:42 10:34:45

perspective on process development and chemistry development. 10:34:51 10:35:00
Q. Who, when you left Semitool, who inherited your – Well, let me back up. 10:35:02 10:35:10
You said you kept these papers. Did you have sort of a prior art file or binder or something like that where you kept literature that you found interesting? 10:35:11 10:35:13 10:35:16 10:35:19
A. I had a number of file cabinets in my office at the time. 10:35:19 10:35:23
Q. And when you left Semitool for Shipley, who inherited those? 10:35:24 10:35:27
A. I don't know who inherited them. 10:35:29
Q. You didn't leave them to anyone specifically? 10:35:30 10:35:32
A. I did not leave them to anyone specifically. They were left behind in my office. And in the course of three years, there were a number of file purges. My recollection is that those kind of documents would have made the cut, so to speak, of significant documents that would have been retained, but it's entirely possible that they may have been purged. 10:35:32 10:35:34 10:35:39 10:35:41 10:35:43 10:35:46 10:35:49 10:35:51
Q. Did you do this literature search by computer? 10:35:57 10:36:00

A. Partially by computer, absolutely. 10:36:00
Q. I'm just trying to retrace your steps. If I went back and tried to find these papers, do you have any suggestions for how I might be able to do it or what key words I should use? 10:36:02 10:36:05 10:36:07 10:36:09
A. "Electroless copper" would certainly be a key word. "Semiconductor applications" would be another one. "Damascene" would be a third, naturally. 10:36:11 10:36:14 10:36:19 10:36:22
This is only one of easily two dozen literature searches that were taking place over that span of time, and I again have a hard time distinguishing this one from others that were taking place either before or after or at the same time. 10:36:22 10:36:26 10:36:28 10:36:32 10:36:34
Q. Do you remember what databases you were using? 10:36:36 10:36:38
A. No, I don't, no, as I sit here. 10:36:39
Q. Do you remember what databases were available at Semitool for you to use? 10:36:53 10:36:55
A. We were – I do not recall whether we were subscribing to specific databases that were fee based or whether we were simply using databases that were uncovered during public domain searches. 10:36:57 10:37:03 10:37:05 10:37:09
Q. Did you ever file or – Let me back up. 10:37:50
Were you ever named inventor on any patent 10:37:56

be Linlin Chen, rather than Chin in the cc line? 10:25:11
A. Yes. 10:25:14
Q. Do you recall what Dr. Chen's involvement 10:25:14 was, if any, with respect to the initial design of 10:25:22 this experiment or was he just – 10:25:27
A. I'm sorry. 10:25:33
MR. RIEDINGER: Compound, two questions. 10:25:34
THE WITNESS: Memory is fallible, as I'm 10:25:36 sure you already appreciate. My recollection is 10:25:38 that Dr. Chen had only been on board at Semitool for 10:25:40 a relatively short period of time. His focus was 10:25:44 not specifically on electroless or on seed layer 10:25:47 repair. He was and is a Ph.D. electrochemist who 10:25:52 was frequently copied on many of the process 10:25:59 development activities as a way of keeping him on 10:26:01 board, in the loop, and also to get the benefit of 10:26:04 his background, but my recollection is that for 10:26:06 these series of experiments, he had little or no 10:26:10 direct involvement in the design or the 10:26:13 implementation. 10:26:15
BY MR. MELNIK: (continuing) 10:26:15
Q. So, the purpose of cc'ing him on this memo 10:26:16 was because he would find this interesting? 10:26:21
MR. RIEDINGER: Objection, leading. 10:26:23
THE WITNESS: The purpose of copying him 10:26:26

on this memo was not only to facilitate his uptake 10:26:27 on the scope of activities that were underway in 10:26:32 process development, but also to solicit his 10:26:35 feedback on any ways that we might improve our 10:26:38 development activities. 10:26:41
BY MR. MELNIK: (continuing) 10:26:42
Q. And who on the Intel side, other than the 10:26:42 two individuals listed here, Shu Jin and Chun Mu, 10:27:23 were involved in interacting with Semitool with 10:27:28 respect to these experiments? 10:27:31
A. My recollection is that we had occasional 10:27:32 discussions involving Jick Yu, but whether Jick was 10:27:43 engaged in this experimental design, I do not 10:27:50 recall. It would have been, however, 10:27:54 contemporaneous with this. 10:27:57
Q. Could you spell his name for us? 10:27:58
A. J-i-c-k, Y-u. 10:27:59
Q. Was it a he? 10:28:05
A. It is a he. 10:28:05
Q. It is a he. 10:28:06
Did you ask the people at Intel not to 10:28:31 disseminate the experimental results that you 10:28:37 communicated to them as part of Experiment 6? 10:28:40
A. I do not recall whether we highlighted 10:28:42 this particular work as being explicitly subject to 10:28:52

that kind of a constraint. I do not recall. My 10:28:58 recollection, however, is that any work done 10:29:03 collaboratively with Intel, that we were explicitly 10:29:07 forbidden to disseminate the results, with the 10:29:14 understanding that they would also keep the results 10:29:17 internal. But whether this particular experiment 10:29:20 called for a restatement of that understanding, I 10:29:27 don't recall. 10:29:29
Q. Were there sometimes – were there times 10:29:30 when experiments were done with an understanding 10:29:36 that the results could be disseminated? 10:29:40
A. Typically it's those circumstances that 10:29:44 were explicitly identified, that the default was 10:29:49 that unless experimental results were specifically 10:29:53 identified as being disseminatable, that in fact 10:29:57 they would by default not be. 10:30:01
Q. And how was such identification made? In 10:30:03 other words, would a particular document be labeled 10:30:08 "Semitool confidential" and the like? 10:30:12
A. Yes. 10:30:13
Q. I guess that's what I'm sort of puzzling 10:30:15 over. As far as I can tell – and maybe you can 10:30:17 correct me – as I look over Exhibit 1000, I didn't 10:30:21 see any preexisting stamps, as opposed to stuff that 10:30:24 lawyers put on it, that said that this was 10:30:29

confidential. Does that help you remember whether 10:30:31 this experiment could have been disseminated by 10:30:34 Intel or not? 10:30:37
A. No, it doesn't. 10:30:37
Q. And why not? 10:30:38
A. Why doesn't it help me remember? 10:30:41
Q. (Nods head.) 10:30:44
A. I don't know. 10:30:45
Q. If you were still at Semitool and you 10:30:59 wanted to go back and figure out whether Intel was 10:31:02 free to disseminate this particular set of 10:31:06 experiments, what would you try to look up or what 10:31:12 documents would you try to dig out? 10:31:16
MR. RIEDINGER: Hypothetical. 10:31:18
THE WITNESS: I don't know how to answer 10:31:20 that. In cases where a formal joint development 10:31:21 agreement existed, it would be specifically 10:31:29 highlighted. In other cases where there was a 10:31:31 statement of understanding or what would – Intel 10:31:36 would refer to as a CITR, which is a confidential 10:31:40 information transfer or transmittal report, that 10:31:46 would also constitute another piece of 10:31:50 documentation. But any discussions with Intel on 10:31:52 process development activities, their typical 10:31:59 approach is to issue a CITR, which is considered to 10:32:01

the early work, did not demonstrate equivalent 10:45:21
success, but nevertheless were anticipated that 10:45:25
they, with further development, might. So 10:45:29
consequently the claims were written to cast as 10:45:32
broad a net as possible. 10:45:35
BY MR. MELNIK: (continuing) 10:45:36
Q. Do you remember if Dr. Chen did 10:46:30
electroless seed repair experiments -- do you 10:46:32
remember if Dr. Chen did any electroless seed repair 10:46:37
experiments? 10:46:40
A. I remember that Dr. Chen used chemistries 10:46:41
that were very similar to conventional electroless 10:46:47
chemistries, but whether they were employed in a 10:46:51
conventional electroless deposition process, I do 10:46:53
not remember. 10:46:56
Q. And the preferred embodiment that you 10:46:56
spoke about just a moment ago, did you have an 10:47:04
alkaline electrolytic seed repair process in mind? 10:47:08
A. That is, to the best of my recollection, 10:47:12
one of the options that was explored with 10:47:17
chemistries that are -- in many cases have parallels 10:47:22
to electroless processes, electroless formulations. 10:47:26
Q. What is your basis for thinking that the 10:47:45
work that was done earlier in 1997, like that 10:47:55
described in Exhibit 1000, influenced Dr. Chen's 10:47:59

later work that led up to the '181 patent? 10:48:04
A. What is the basis? 10:48:07
Q. Funny lawyer way of saying really how do 10:48:14
you know. 10:48:16
A. How do I know. I was not a co-inventor of 10:48:17
this, but was involved in a number of different 10:48:21
roles, not only during the 1997 time frame, though 10:48:26
shortly thereafter -- you said we were going to 10:48:31
triangulate on time frames -- shortly thereafter 10:48:33
moving into a marketing role, but then at the 10:48:35
conclusion of my tenure at Semitool was the general 10:48:38
manager of the group and was involved, though not in 10:48:42
exhaustive detail, in discussions related to the 10:48:50
patent estate. And I recall that discussions on the 10:48:56
importance of a seed layer -- 10:48:59
MR. RIEDINGER: I want you to continue to 10:49:02
answer, but I'd like to advise you that Semitool has 10:49:04
not waived its attorney-client privilege in this 10:49:07
case, and so we do not believe it's appropriate for 10:49:09
you to reveal the substance of communications by 10:49:13
Semitool's attorneys that may have been made to you, 10:49:17
including communications about the strategy and so 10:49:20
forth in Semitool's patent applications. You can 10:49:24
describe the existence of such communications and 10:49:28
who participated and dates, but not the substance, 10:49:30

please. 10:49:33
THE WITNESS: All right. Thank you. 10:49:33
Discussions as to the potential 10:49:35
applicability of electroless-like chemistries for 10:49:38
seed layer repair took place in the context of the 10:49:43
work that Dr. Chen did, discussions in which I, Tom 10:49:47
Ritzdorf and Dr. Chen were involved. 10:49:52
BY MR. MELNIK: (continuing) 10:49:55
Q. And this was during what time frame? I'm 10:49:55
sorry. 10:49:57
A. This would have been at the period of time 10:49:57
when Dr. Chen was doing the bulk of his work leading 10:50:01
up to the filing for this patent. So this would 10:50:05
have been in the '90 -- I'm sorry. 10:50:08
Q. Let me see if I can help you. The filing 10:50:17
date of the patent is March 20th, 1998. 10:50:19
A. So this would have been in the late '97 10:50:22
time frame. 10:50:24
Q. And did you feel at the time you were 10:50:25
having these discussions with Tom Ritzdorf and 10:50:45
Linlin Chen that Dr. Chen had invented the concept 10:50:50
of seed layer repair generally? 10:50:54
MR. RIEDINGER: Objection, calls for an 10:50:59
opinion. 10:51:00
THE WITNESS: My recollection is that 10:51:13

Dr. Chen invented the embodiment that is described 10:51:17
in this patent, but the concept of seed layer repair 10:51:20
actually grew out of a concept for a broader 10:51:28
technology of ECDC layer, a replacement for PVD, 10:51:33
which involved discussions and input that included 10:51:38
those from Tom Ritzdorf, from myself, from Henry 10:51:46
Stevens, et al. 10:51:50
BY MR. MELNIK: (continuing) 10:51:51
Q. And when you say ECDC layer, do you mean 10:51:52
direct on-barrier deposition of a seed layer? 10:51:59
A. Yes. That's one of the names that it goes 10:52:01
by. 10:52:04
Q. And the reason why one grew out of the 10:52:04
other -- Well, let me back up. 10:52:08
During -- let's take an alkaline 10:52:13
electrolytic process for depositing directly on 10:52:17
barrier. Is there a point early in that process 10:52:20
when the state of nucleation is such that you 10:52:24
essentially have a bunch of little copper eyelets on 10:52:30
the barrier? 10:52:32
MR. RIEDINGER: Objection, lacks 10:52:33
foundation. 10:52:34
THE WITNESS: The process that you 10:52:35
described is extremely sensitive to the surface 10:52:40
state of the barrier itself, and therefore 10:52:46

applications that Semitool filed with respect to the work described in Exhibit 1000?

A. I do not believe that I was ever a named inventor on work that was related to electroless plating.

Q. Do you know if Semitool ever filed any patent applications on electroless seed repair?

A. I do not know that that happened.

Q. Do you know if Semitool filed any patent applications on work that included the Intel experiments described in Exhibit 1000?

A. My recollection is that at the time that a patent application was filed describing seed repair technology, per se, that it was clear that this was one of the approaches that had been pursued, and consequently was -- influenced the way the claims were written.

Q. When you say that this was one of the approaches, are you referring to electroless seed repair?

A. Yes.

Q. And when you say that it had been pursued, do you mean pursued by people such as, for example, the Leti workers and Professor Palmans out in the open literature?

A. No. I mean that it was pursued internally, explicitly for the purposes of seed repair in the context of, as an example, customer demonstrations, such as the one described in Exhibit 1000.

Q. And which seed repair application -- patent applications did you have in mind in your previous answer?

MR. RIEDINGER: Objection, foundation.

THE WITNESS: I'm sorry, but the one that led to this issued patent, '6197, et cetera.

BY MR. MELNIK: (continuing)

Q. The Chen '181 patent?

A. Yes.

MR. MELNIK: Have we marked this previously as Exhibit 1?

MR. BOBROW: Plaintiff's Exhibit 1.

MR. MELNIK: Plaintiff's Exhibit 1.

Let me mark as Exhibit 1037, I think is our next number -- actually, no, wait a minute. This was marked before. My apologies. If I can find what its previous number was.

BY MR. MELNIK: (continuing)

Q. Let me give you what has previously been marked as Exhibit 1002, Semitool's supplemental

responses to Applied Materials' first set of interrogatories. And I will just point you to interrogatory No. 3, and if you could just skim the question and answer.

A. No. 3.

MR. RIEDINGER: Do you have an additional copy for me, Mr. Melnick?

MR. MELNIK: (Handing.)

MR. RIEDINGER: Thank you.

BY MR. MELNIK: (continuing)

Q. You can stop after the line that says "Jeff Turner."

A. Well, thank you.

Q. The rest is just lawyer stuff.

You'll notice that Semitool has identified you as a person who is -- who possibly has some knowledge regarding the conception and reduction to practice of the '181 patent.

In your view how, if at all, did the -- this work that we were discussing in Exhibit 1000, the electroless seed repair work, influence Dr. Chen's later work that led up to the '181 patent?

MR. RIEDINGER: Calls for an opinion. It assumes facts not testified to.

THE WITNESS: That objection having been made, I assume that the prior understanding still exists, and that I --

BY MR. MELNIK: (continuing)

Q. Yes.

MR. RIEDINGER: You do answer after --

THE WITNESS: That's quite all right.

MR. RIEDINGER: -- I place my objection on the record. It's for later use.

THE WITNESS: Thank you.

My recollection is that it was among the variety of techniques that were available, described in different applications in detail in the literature that were part of the electro deposition repertoire that were understood by people skilled in the art; that the work Dr. Chen did in leading up to this '181 patent investigated a number of those and variants of those.

And my further recollection is that in writing patent claims, that it was important to make them as broadly applicable as possible. There was a -- there is a preferred embodiment that is described in detail in this '181 patent. It was the embodiment that was found to be best. Others that were explored did not demonstrate, at least during

experiments, some on Ti nitride, some on tantalum nitride, some work better than others. What is it that motivated you from the results of those experiments to now go to seed repair? 11:13:18 11:13:23 11:13:27 11:13:29

A. Direct on-barrier plating is motivated by two things: one is the elimination of the requirement to have a separate process for barrier deposition; and the second – the second one was because of the inadequacy of the existing processes, the fact that high-aspect ratio features were very frequently imperfectly coated, covered, sheathed by PVD deposition, which makes the electroplating process look as though it has flaws, when in fact those flaws were a preexisting condition. 11:13:36 11:13:42 11:13:45 11:13:50 11:13:54 11:13:59 11:14:03 11:14:08 11:14:12 11:14:15

So the whole motivation for direct on-barrier plating, that was the Holy Grail, so to speak. Seed layer repair was a Dixie cup. It was an acknowledgment that if the overall seed layer process itself couldn't be eliminated, that at least the flaws in it could be ameliorated by a process that was of the nature described here. 11:14:18 11:14:20 11:14:25 11:14:31 11:14:36 11:14:41 11:14:45

So, the whole motivation for it is that if you couldn't get a home run by eliminating the requirement for the barrier altogether, or more specifically the seed layer, the PVD-deposited seed 11:14:48 11:14:51 11:14:56 11:14:58

layer altogether, at least you could avoid having the electroplating process results hampered by a poor seed layer deposition process. 11:15:02 11:15:04 11:15:09

Q. And was the logical connection between the two the fact that in a discontinuous PVD seed layer the barrier is peeking through the discontinuities, so it's sort of like plating on barrier, except with the eyelets already there? 11:15:12 11:15:15 11:15:19 11:15:22 11:15:25

MR. RIEDINGER: Objection, foundation. 11:15:27

THE WITNESS: The idea wasn't the fact that the exposed barrier was in some way a good situation, it was that that barrier could potentially be covered by copper deposited laterally, if you will, from the discontinuous eyelets. So, the idea was that if you could in fact deposit a very conformal copper film, a very thin copper film, and cover up or bridge the discontinuities, that you could achieve what you needed for the subsequent high-rate full-thickness Damascene bottom-up super-fill copper. 11:15:28 11:15:34 11:15:36 11:15:38 11:15:42 11:15:45 11:15:50 11:15:56 11:16:00 11:16:03 11:16:07

BY MR. MELNIK: (continuing) 11:16:11

Q. No, I didn't mean to suggest that the barrier peeking through was a good thing. I guess what I was asking rather was that whether the presence of the barrier peeking through the 11:16:16 11:16:18 11:16:20 11:16:22

discontinuities in the PVD seed was the conceptual parallel, as it were, between seed layer repair work and direct on-barrier work. 11:16:25 11:16:29 11:16:32

A. I would have to say yes, the idea was that you were attempting to cover up an exposed barrier, in some cases very small and localized. In the direct on-barrier plating, obviously over the entire surface. 11:16:36 11:16:41 11:16:45 11:16:50 11:16:52

Q. Do you remember Pat Burkhardt? 11:16:56

A. Pat Burkhardt? The name is familiar. You'd have to provide a context. 11:16:58 11:17:01

Q. He was, I believe, a lawyer at Semitool in 1997. 11:17:02 11:17:05

A. Oh, yes, I remember Pat Burkhardt. 11:17:05

Q. Did you work with Pat under some circumstances during 1997? 11:17:08 11:17:17

A. I had a number of discussions with Pat both – yes, worked with Pat. 11:17:18 11:17:21

Q. Did those discussions relate generally to patent applications? 11:17:25 11:17:30

A. Generally, yes. 11:17:31

Q. Did any of them relate to patent applications on which you were a named inventor? 11:17:32 11:17:34

A. I do not recall specifically what patent applications I was a named inventor on, as opposed 11:17:39 11:17:51

to or as contrasted with the patent applications on which members of the ATG group who worked in my organization were the named inventors on. I don't remember. 11:17:57 11:18:00 11:18:04 11:18:06

Q. Do you remember if you discussed with Mr. Burkhardt any seed layer repair patent applications? 11:18:09 11:18:13 11:18:17

A. I don't. 11:18:17

MR. RIEDINGER: Mr. Taylor, I'm going to object to your answering the question. Semitool has not waived the privilege, so we would object to discussions of the substance of the communication. 11:18:18 11:18:21 11:18:23 11:18:26

THE WITNESS: Understood. 11:18:28

I don't recall whether discussions with Pat Burkhardt involved seed layer repair applications or disclosures or whatever. 11:18:29 11:18:31 11:18:34

BY MR. MELNIK: (continuing) 11:18:36

Q. Do you remember the circumstances under which Mr. Burkhardt left? 11:18:38 11:18:39

A. Not specifically, no. 11:18:44

Q. Do you remember anything about the circumstances under which he left? 11:18:55 11:18:57

A. I remember only the fact that he was displeased, so I do not believe it was voluntary. 11:18:58 11:19:04

Q. Do you know what he was displeased about? 11:19:06

impossible to generalize. What you observe in the 10:52:48
early state of nucleation will be highly dependent 10:52:51
on whether the barrier you're using is of one 10:52:55
composition or another, was deposited in one way or 10:53:01
another, is oxidized to certain degrees. So it's 10:53:03
difficult – or impossible to generalize. 10:53:07
BY MR. MELNIK: (continuing) 10:53:09
Q. Then let me ask it this way. When you 10:53:09
said that the seed layer repair work grew out of the 10:53:11
direct on-barrier work, what was the conceptual 10:53:14
relationship that caused one to grow out of the 10:53:19
other? 10:53:21
A. The conceptual relationship was a 10:53:21
discovery of these tremendous sensitivities to the 10:53:23
surface state of the barrier itself, and the 10:53:29
observation that direct on-barrier plating on the 10:53:32
barrier that was emerging as the preferred 10:53:35
formulation in the industry was difficult or 10:53:38
impossible to achieve with our current state of 10:53:44
understanding, though we observed as a consequence 10:53:47
of that work that if there was, in fact, a thin, 10:53:49
preexisting copper layer, that we could achieve a 10:53:52
successful deposition. 10:53:56
Q. And which barrier material was this? 10:53:58
A. The barrier material that was emerging as 10:54:00

the preferred barrier for Damascene applications was 10:54:04
a tantalum nitride. 10:54:08
Q. And on tantalum nitride, assuming it's 10:54:18
properly cleaned, if one is doing direct on-barrier 10:54:21
electrolytic deposition, let's say, from an alkaline 10:54:27
bath, is there a time point where the – early on in 10:54:30
the deposition where the copper material has sort of 10:54:39
nucleated into eyelets of copper with naked barrier 10:54:43
in between? Is that how this is generally 10:54:48
conceptualized? 10:54:51
MR. RIEDINGER: Hypothetical. 10:54:52
THE WITNESS: At the time that I was 10:54:54
involved directly, with the foreknowledge that 10:54:55
things may have changed in the course of the last 10:55:00
two years, at the time our conclusion was that 10:55:02
tantalum nitride itself was nearly electrochemically 10:55:06
inert, and achieving any form of adherent deposition 10:55:11
with copper, whether as isolated eyelets or as 10:55:15
continuous film, was extremely difficult. We 10:55:19
observed on alternative barrier films was a 10:55:22
phenomenon much as you described, but not 10:55:29
necessarily on tantalum nitride. 10:55:31
BY MR. MELNIK: (continuing) 10:55:32
Q. So let's say on CVD Ti nitride barriers, 10:55:34
one would see this kind of process? 10:55:37

A. That is my recollection, is that on 10:55:39
titanium nitride it was much easier to initiate 10:55:42
direct on-barrier plating, and it typically 10:55:47
proceeded from the initial nucleation of eyelets 10:55:49
that would subsequently merge. 10:55:52
Q. And those kinds of eyelets are sort of 10:55:54
similar to a discontinuous PVD seed? Is that the 10:55:58
conceptual connection? 10:56:03
MR. RIEDINGER: Objection, leading. 10:56:03
THE WITNESS: The conceptual connection. 10:56:04
BY MR. MELNIK: (continuing) 10:56:07
Q. I'm sorry. You said yes, that's the 10:56:08
conceptual connection? 10:56:10
A. No, no, no, I didn't. I'm sorry, 10:56:10
connection to what? 10:56:12
Q. Between direct on-barrier plating – 10:56:13
excuse me – and seed repair. 10:56:16
A. No. The connection was the observation 10:56:21
that seed repair could in fact bridge or could – 10:56:24
had the potential to bridge eyelets of discontinuous 10:56:31
copper deposited by conventional PVD, but was 10:56:36
incapable of depositing a continuous film directly 10:56:40
on something like a tantalum nitride. 10:56:44
What you say is logically connected, but 10:56:47
what we – I'm not saying that we necessarily made 10:56:49

that explicit logical sequential connection, saying 10:56:53
that if eyelets form on titanium nitride and can 10:56:58
subsequently be bridged successfully with an 10:57:03
alkaline electrolytic bath, therefore we should be 10:57:06
able to do seed repair. It was a question of 10:57:08
observing that a continuous film could be formed on 10:57:10
a discontinuous PVD seed, but no continuous 10:57:14
deposition could be achieved on tantalum, tantalum 10:57:21
nitride. An attempt to do it on tantalum, direct 10:57:24
on-barrier plating electrolytically on tantalum 10:57:27
tantalum nitride wasn't successful, but an ability 10:57:28
to use a discontinuous thin seed – or a preexisting 10:57:33
PVD seed was. 10:57:37
MR. MELNIK: Why don't we take a short 10:57:46
break. 10:57:48
THE WITNESS: I would appreciate it. 10:57:48
(A recess is then taken.) 10:57:50
THE VIDEOGRAPHER: Back on the record. 11:12:53
The time is 11:12 a.m. 11:12:55
BY MR. MELNIK: (continuing) 11:12:57
Q. Okay. So before the break we were 11:12:58
discussing the direct on-barrier plating 11:13:00
experiments, and I have another question because I 11:13:06
was puzzling about your answers over the break. 11:13:09
So you do these direct on-barrier plating 11:13:11

Cross and Bob Pollett were the only two that would have been participants in that discussion. I don't recall talking with any of the other attorneys on this topic.

Q. And with respect to the technical team discussions, do you recall who else might have participated in these conversations?

A. Well, who else might have participated? My read of this Exhibit 1002 is that those -- that is a list of the individuals who would have had knowledge of either the content of the '181 patent or any other related technologies.

Q. And you were referring to Semitool's Interrogatory response?

A. Interrogatory response, if that was the right number.

MR. MELNIK: Subject to redirect, I don't have any further questions.

MR. BOBROW: On behalf of Applied Materials, I have no questions, subject to redirect on questions by either Ebara or by Semitool.

MR. KEARNEY: I have no questions, subject to reservation of redirect.

MR. RIEDINGER: Can we take a quick break so I can consult with co-counsel.

THE VIDEOGRAPHER: Off the record.

(A recess is then taken.)

THE VIDEOGRAPHER: On the record.

MR. RIEDINGER: We have no questions.

Thank you very much, Mr. Taylor.

THE WITNESS: My pleasure.

MR. MELNIK: And Mr. Taylor, as I was explaining during the break, but I'll just repeat it, at some point the court reporter will send you a copy of the transcript. You should read over it, and if anything got mistranscribed or if there is -- if there are any answers that you want to supplement, you're welcome to do so, just type up your supplemental answer or hand write it or whatever you like, call one of us, we'll send a notary over to notarize it for you, and that will be your supplemental testimony. So please feel free to do that if there's something you need to add.

THE WITNESS: And one more time, to whom should that be submitted?

MR. RIEDINGER: To the court reporter.

THE WITNESS: To the court reporter.

MR. MELNIK: So you should grab one of her cards.

THE WITNESS: Very good, very good. What

are my ongoing obligations from this point?

MR. MELNIK: Don't destroy documents.

THE WITNESS: Okay. Very good. Is it common practice to be recalled for further questions?

MR. MELNIK: No.

THE WITNESS: Fine.

MR. RIEDINGER: The trial is scheduled in more than a year from now, in the summer of 2003, and I don't think any of the parties have decided yet who they want to have as trial witnesses, so if you're wondering if you're going to be called as a witness at trial, I don't think anybody knows yet.

THE WITNESS: Understood.

MR. RIEDINGER: Thank you.

THE VIDEOGRAPHER: Off the record.

(Deposition concluded at 11:32 a.m.)

CERTIFICATE

I, Bonita J. Alexander, Certified Shorthand Reporter for Oregon, Registered Merit Reporter and Registered Professional Reporter, do hereby certify that THOMAS TAYLOR personally appeared before me at the time and place set forth herein; that at said time and place I reported in stenotype all testimony adduced and other oral proceedings had in the foregoing matter; that thereafter my notes were transcribed using computer-aided transcription under my direction; and the foregoing transcript, pages 1 to 60, both inclusive, constitutes a full, true and accurate record of such testimony adduced and oral proceedings had and of the whole thereof.

Witness my hand and stamp at Portland, Oregon, this 29th day of March, 2002.

Bonita J. Alexander, RMR, RPR,
CRR, Oregon Certified Shorthand
Reporter No. 95-0315

A. I believe he was displeased at losing his employment. That's my recollection. 11:19:11 11:19:15

Q. Do you remember if there was anything about which he was displeased prior to his losing his employment? 11:19:20 11:19:24 11:19:27

A. No, I don't remember that there was anything specifically that he was displeased about. As I noted a moment ago, it took me a while to even remember who the person was, much less the many details about, you know, his work. 11:19:28 11:19:35 11:19:38 11:19:42 11:19:44

My recollection, as we're discussing it, is that there were -- it was extremely difficult at times to track him down, to get his attention. I think that may have had something to do with his subsequent departure from the company. 11:19:52 11:19:54 11:19:57 11:20:01 11:20:04

Q. Do you know who Bob Pollett is? 11:20:07

A. Bob Pollett, yes. As a matter of fact, he, from what I recall, at least, he is an attorney at a firm that's retained by Semitool, patent attorney. 11:20:10 11:20:13 11:20:17 11:20:24

Q. Did you ever have any meetings or discussions with Mr. Pollett relating to any patent applications? 11:20:24 11:20:26 11:20:29

A. Oh, yes. That's why I recall. That's why I remember him. 11:20:30 11:20:32

Q. Do you remember if you ever participated in any meetings with Mr. Pollett relating to any Semitool applications relating to seed repair? 11:20:34 11:20:38 11:20:41

A. I do not recall any specific conversations. It -- I do not recall specific conversations about seed repair with Bob Pollett. By the same token, I don't recall whether that was -- let me put this -- I don't recall one way or the other. 11:20:43 11:20:45 11:20:48 11:20:52 11:20:58 11:21:01

Q. Do you know if you ever shared with Bob Pollett copies of either or any of the IMEC papers or the Leti papers on seed repair that we were chatting about earlier? 11:21:06 11:21:09 11:21:14 11:21:17

A. I don't recall bringing them to his attention. 11:21:25 11:21:27

Q. Obviously you know Mr. Cross. 11:21:31

A. Yes. 11:21:33

Q. Do you recall having any meetings with Mr. Cross to discuss Semitool patent applications? 11:21:34 11:21:37

A. Yes. 11:21:44

Q. Do you recall if any of those meetings related to seed repair patent applications? 11:21:46 11:21:49

A. Excuse me just a moment. I'm going to have to tell you something, though. Absent the ability to remember a specific meeting, it's 11:21:51 11:21:55 11:21:57

difficult for me to say that a given topic was necessarily discussed. I almost have to remember details of a given conversation, and the fact is that I don't. I know that we had an intensive effort to discuss any and all of the potentially protectable development work that was taking place, but I do not recall a specific conversation or the content of any conversation with Pete Cross -- Harry Cross -- on the issue of seed repair. 11:22:00 11:22:05 11:22:08 11:22:11 11:22:15 11:22:24 11:22:30 11:22:34 11:22:38

Q. I certainly understand that the reason why lawyers ask these questions is sometimes in the middle of the answer, the witness -- a light bulb will go on and the witness will say, "Oh, now I remember." That's why we ask. 11:22:41 11:22:45 11:22:48 11:22:52 11:22:56

A. Yes. 11:22:59

Q. And thinking back to the Leti and IMEC papers on seed repair that we were chatting about earlier, do you remember if you ever provided a copy of those to Pete Cross? 11:22:59 11:23:03 11:23:05 11:23:07

A. No. In fact -- please excuse me, but I want to -- during the break it was my recollection, my recall of the work done at IMEC is significantly clearer than a recall of a specific document or paper from Leti. That one is vaguer. But I do -- and I gave you, of course, Dr. Roger Palmans' name, 11:23:09 11:23:13 11:23:19 11:23:23 11:23:27 11:23:31

but the IMEC paper is the one that's clearest in my mind, I do not recall giving a copy of that specifically to Pete Cross. 11:23:34 11:23:37 11:23:40

Q. Okay. 11:23:48

A. Harry Cross. I want to make sure we're talking about the same person. 11:23:49 11:23:50

Q. I think pretty much everyone has called Mr. Cross Pete Cross in this case, including the judge. So I think we're okay. 11:23:51 11:23:54 11:23:56

Do you recall if there were -- Let me back up. Do you recall any of the meetings with the lawyers that dealt with the subject of seed repair patent applications? 11:24:12 11:24:19 11:24:25 11:24:33

A. I remember the discussions with the technical team with greater clarity than I do discussions with the lawyers. I do not recall specific discussions with any of the lawyers, either employed by Semitool or retained by them on this topic. 11:24:34 11:24:43 11:24:49 11:24:52 11:24:56 11:25:00

Q. As opposed to specific discussions, do you perhaps remember which lawyers other than Mr. Cross and Mr. Pollett might have participated in discussions related to seed layer repair patent applications? 11:25:04 11:25:07 11:25:11 11:25:14 11:25:17

A. To the best of my recollection, Harry 11:25:17

D

E

10:18:08 25:17
10:18:10 25:18
10:18:11 25:19
10:18:12 25:20,21
10:18:13 25:22
10:18:17 25:23
10:18:20 25:24
10:18:22 25:25
10:18:26 26:1
10:18:28 26:2
10:18:32 26:3
10:18:36 26:4
10:18:39 26:5
10:18:43 26:6
10:18:46 26:7
10:18:47 26:8
10:18:50 26:9
10:18:56 26:10
10:19:00 26:11
10:19:02 26:12
10:19:04 26:13
10:19:21 26:14
10:19:26 26:15,16
10:19:30 26:17
10:19:33 26:18
10:19:37 26:19
10:19:39 26:20
10:19:42 26:21
10:19:45 26:22,23
10:19:47 26:24
10:20:52 26:25
10:20:56 27:1
10:21:01 27:2
10:21:05 27:3
10:21:09 27:4
10:21:11 27:5
10:21:14 27:6
10:21:15 27:7
10:21:16 27:8
10:21:18 27:9
10:21:20 27:10
10:22:04 27:11
10:22:05 27:12
10:22:07 27:13
10:22:09 27:14
10:22:14 27:15
10:22:16 27:16
10:22:17 27:17,18
10:22:19 27:19
10:22:22 27:20
10:22:26 27:21
10:22:30 27:22
10:22:31 27:23
10:22:34 27:24
10:22:37 27:25 28:1
10:22:40 28:2
10:22:43 28:3
10:22:46 28:4
10:22:48 28:5
10:22:51 28:6
10:22:53 28:7
10:22:55 28:8
10:22:57 28:9
10:22:58 28:10
10:23:02 28:11
10:23:05 28:12
10:23:08 28:13
10:23:13 28:14
10:23:17 28:15
10:23:20 28:16
10:23:23 28:17
10:23:28 28:18
10:23:37 28:19
10:23:39 28:20
10:23:42 28:21
10:23:47 28:22
10:23:50 28:23
10:23:53 28:24
10:23:58 28:25
10:24:01 29:1
10:24:05 29:2
10:24:06 29:3
10:24:10 29:4
10:24:13 29:5
10:24:14 29:6
10:24:16 29:7
10:24:24 29:8
10:24:25 29:9,10
10:24:30 29:11
10:24:34 29:12
10:24:36 29:13
10:24:40 29:14
10:24:42 29:15
10:24:47 29:16
10:24:49 29:17
10:24:52 29:18
10:24:55 29:19
10:24:57 29:20,21
10:25:00 29:22
10:25:02 29:23
10:25:04 29:24
10:25:06 29:25
10:25:11 30:1
10:25:14 30:2,3
10:25:22 30:4
10:25:27 30:5
10:25:33 30:6
10:25:34 30:7
10:25:36 30:8
10:25:38 30:9
10:25:40 30:10
10:25:44 30:11
10:25:47 30:12
10:25:52 30:13
10:25:59 30:14
10:26:01 30:15
10:26:04 30:16
10:26:06 30:17
10:26:10 30:18
10:26:13 30:19
10:26:15 30:20,21
10:26:16 30:22
10:26:21 30:23
10:26:23 30:24
10:26:26 30:25
10:26:27 31:1
10:26:32 31:2
10:26:35 31:3
10:26:38 31:4
10:26:41 31:5
10:26:42 31:6,7
10:27:23 31:8
10:27:28 31:9
10:27:31 31:10
10:27:32 31:11
10:27:43 31:12
10:27:50 31:13
10:27:54 31:14
10:27:57 31:15
10:27:58 31:16
10:27:59 31:17
10:28:05 31:18,19
10:28:06 31:20
10:28:31 31:21
10:28:37 31:22
10:28:40 31:23
10:28:42 31:24
10:28:52 31:25
10:28:58 32:1
10:29:03 32:2
10:29:07 32:3
10:29:14 32:4
10:29:17 32:5
10:29:20 32:6
10:29:27 32:7
10:29:29 32:8
10:29:30 32:9
10:29:36 32:10
10:29:40 32:11
10:29:44 32:12
10:29:49 32:13
10:29:53 32:14
10:29:57 32:15
10:30:01 32:16
10:30:03 32:17
10:30:08 32:18
10:30:12 32:19
10:30:13 32:20
10:30:15 32:21
10:30:17 32:22
10:30:21 32:23
10:30:24 32:24
10:30:29 32:25
10:30:31 33:1
10:30:34 33:2
10:30:37 33:3,4
10:30:38 33:5
10:30:41 33:6
10:30:44 33:7
10:30:45 33:8
10:30:59 33:9
10:31:02 33:10
10:31:06 33:11
10:31:12 33:12
10:31:16 33:13
10:31:18 33:14
10:31:20 33:15
10:31:21 33:16
10:31:29 33:17
10:31:31 33:18
10:31:36 33:19
10:31:40 33:20
10:31:46 33:21
10:31:50 33:22
10:31:52 33:23
10:31:59 33:24
10:32:01 33:25
10:32:07 34:1
10:32:14 34:2
10:32:15 34:3
10:32:23 34:4,5
10:32:26 34:6
10:32:29 34:7
10:32:32 34:8
10:32:33 34:9
10:32:40 34:10
10:32:45 34:11
10:32:51 34:12
10:32:53 34:13
10:32:55 34:14
10:32:58 34:15
10:33:03 34:16
10:33:05 34:17
10:33:11 34:18
10:33:13 34:19
10:33:17 34:20
10:33:18 34:21
10:33:19 34:22
10:33:20 34:23
10:33:21 34:24
10:33:23 34:25
10:33:25 35:1
10:33:27 35:2,3,4
10:33:33 35:5
10:33:39 35:6
10:33:40 35:7
10:33:42 35:8
10:33:44 35:9
10:33:45 35:10
10:33:47 35:11
10:33:50 35:12
10:33:53 35:13
10:33:55 35:14
10:34:06 35:15
10:34:09 35:16
10:34:11 35:17
10:34:13 35:18
10:34:16 35:19
10:34:23 35:20
10:34:26 35:21
10:34:34 35:22
10:34:40 35:23
10:34:42 35:24
10:34:45 35:25
10:34:51 36:1
10:35:00 36:2
10:35:02 36:3
10:35:10 36:4
10:35:11 36:5
10:35:13 36:6
10:35:16 36:7
10:35:19 36:8,9
10:35:23 36:10
10:35:24 36:11
10:35:27 36:12
10:35:29 36:13
10:35:30 36:14
10:35:32 36:15,16
10:35:34 36:17
10:35:39 36:18
10:35:41 36:19
10:35:43 36:20
10:35:46 36:21
10:35:49 36:22
10:35:51 36:23
10:35:57 36:24
10:36:00 36:25 37:1
10:36:02 37:2
10:36:05 37:3
10:36:07 37:4
10:36:09 37:5
10:36:11 37:6
10:36:14 37:7
10:36:19 37:8
10:36:22 37:9,10
10:36:26 37:11
10:36:28 37:12
10:36:32 37:13
10:36:34 37:14
10:36:36 37:15
10:36:38 37:16
10:36:39 37:17
10:36:53 37:18
10:36:55 37:19
10:36:57 37:20
10:37:03 37:21
10:37:05 37:22
10:37:09 37:23
10:37:50 37:24
10:37:56 37:25
10:37:59 38:1
10:38:04 38:2
10:38:05 38:3
10:38:12 38:4
10:38:16 38:5
10:38:19 38:6
10:38:21 38:7
10:38:24 38:8
10:38:33 38:9
10:38:36 38:10
10:38:42 38:11
10:38:58 38:12
10:39:08 38:13
10:39:14 38:14
10:39:18 38:15
10:39:24 38:16
10:39:27 38:17
10:39:33 38:18
10:39:36 38:19
10:39:39 38:20,21,22
10:39:43 38:23
10:39:48 38:24
10:39:53 38:25 39:1
10:39:58 39:2
10:40:02 39:3
10:40:06 39:4
10:40:09 39:5
10:40:15 39:6
10:40:25 39:7
10:40:27 39:8
10:40:28 39:9
10:40:29 39:10
10:40:31 39:11
10:40:34 39:12,13
10:40:37 39:14
10:40:40 39:15
10:40:41 39:16
10:40:44 39:17
10:40:49 39:18
10:41:33 39:19

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF OREGON

SEMITOOL, INC.,
Plaintiff,

vs. No. 16-01-06060

NOVELLUS SYSTEMS, INC.,
Defendant.

HIGHLY CONFIDENTIAL
VIDEOTAPED DEPOSITION OF
THOMAS TAYLOR
VOLUME II
October 23, 2002
9:15 a.m.

6011 SW Second Avenue
Suite 1600
Portland, Oregon

Carol Ann Nevarez, Certified Shorthand Reporter for Oregon

APPEARANCES:
Counsel for the Plaintiff, Semitool:
JERRY A. RIEDINGER, Esquire
MICHAEL D. BROADDUS, Esquire
PAUL T. FORTINO, Esquire
Perkins Coie LLP
1201 Third Avenue
Forty Eighth Floor
Seattle, Washington 98101
(206) 583-8888

Corporate Counsel for the Plaintiff:
HARRY M. CROSS, JR., Esquire
Semitool, Inc.
655 West Reserve Drive
Calispell, Montana 59901

Counsel for the Defendant, Novellus:
ROMAN MELNIK, Esquire
Irell & Manella LLP
1800 Avenue of the Stars
Suite 900
Los Angeles, CA 90067
(310) 227-1010
-and-

Counsel for the Defendant, Applied Materials:
NICHOLAS A. BROWN, Esquire
Weil, Gotshal & Manges LLP
201 Redwood Shores Parkway
Redwood Shores, California 94065
(650) 802-3034

Also Present:
Dennis Jouno, Videographer

Deposition of Thomas Taylor, Volume II
October 23, 2002

THOMAS TAYLOR, having been first duly sworn on oath by the Certified Shorthand Reporter to tell the truth, the whole truth, and nothing but the truth, was examined and testified as follows:

EXAMINATION

BY-MR.RIEDINGER:

Q. Thank you, Mr. Taylor and thank you for coming back for another session. We appreciate it.

What I would like to do today is, go over some documents that describe activity that you were involved with when you were at Semitool, activity principally in 1997, but starting in the end of 1996.

I would like to say that several of the documents that we're going over came from this book. I don't know whether it's a book that you were familiar with when you were at Semitool, but it is a chronological file of some of the ATG group meetings, and if you would like to look at the originals, several of them are in here. And perhaps,

Page 66

you would find them useful.
Before we start going over that activity, I would just like to bring your foundation up-to-date. Are you currently employed by Applied Materials?
A. Yes, I am.
Q. What is your position?
A. My position is Director of Product Technology. I'm specifically focusing on electrochemical deposition technologies and programs between Applied Materials and Intel.
Q. And when did you begin your employment with Applied?
A. April of this year.
Q. Do you have a specific date?
A. April 1st.
Q. Hopefully, that's not significant. April Fools Day.
A. There were a few comments made along those lines.
Q. All right. I would like to begin with a document that is one of the two documents that we sent to you gentlemen yesterday, and the court reporter has premarked as Exhibit-50, the document bearing

Page 67

Semitool production numbers ST021359 through 362. And I place that before you, Mr. Taylor. Do you recognize Exhibit 50?
A. If you will give me just a moment.
Q. Sure.
A. I recognize the latter pages, and I know that I wrote the first ones -- at least, it's clear that I did, but I don't remember having written it specifically. But I do remember, in fact, producing the -- the matrixes that are listed at the end.
Q. The final two pages --
A. Yes.
Q. -- having tables?
A. Yes.
Q. -- of numbers or --
A. Conditions.
Q. -- conditions?
MR. BROWN: One thing, just so you know, because the court reporter is taking down what you say, you need to try to let him finish his question before you answer. Often, that's hard, but let him articulate a complete question and then answer.
MR. MELNIK: And particularly,

Page 68

because you have a great chorus on this side because I have to articulate objections separately, so there will be a cascade down the table.
BY MR. RIEDINGER:
Q. Mr. Taylor, does your signature appear on the second page?
A. Yes, it does.
Q. And is that a date next to your signature?
A. Yes, it is.
Q. Is that date in your handwriting?
A. Yes, it is.
Q. Does that indicate that Exhibit 50 was prepared on or about the 24th of October of 1996?
A. Yes, it does.
Q. What was your position at Semitool in October of 1996?
A. The actual job title, I don't recall clearly, but in effect, it was the Manager of Process Development.
Q. Was Exhibit 50 prepared as part of your work as the Manager of Process Development?

Page 69

A. Yes.
Q. The subject of Exhibit 50 is Plating Process Characterization Experiments. What, if anything, does that mean to you?
A. I'm not exactly sure how to answer the question because, in effect, that's exactly what it means is the recommendation for experiments to be conducted to characterize plating process capabilities.
Q. Was Exhibit 50 a recommendation by you that such characterization experiments be conducted?
A. Yes.
Q. If I look at the very first paragraph on the first page of Exhibit 50, it refers to recommendations for the first two of a series of experiments intended to lead to complete characterization, et cetera.
Why were you recommending experiments at the time?
A. I do not remember exactly what was my motivation at the time. However, my recollection -- partial recollection is that I was unsatisfied with the depth of understanding that we had on the impact of

Page 74

A. These tables identify what was -- which was characterized on the first page as fractional factorial experiments intended to be as efficient as possible in the number of experimental runs conducted to characterize the results of parameters such as, electrolyte flow, wafer rotation speed, separation between the wafer and the immersed anode and the separation between the anode and an immersed diffuser on plated film uniformity.
Q. Did either -- I'm sorry -- were you finished?
A. Yes, I am finished.
Q. Did either of experiments one or two of the last two pages of Exhibit 50, did they involve seed layers?
A. Involve seed layers insofar as the wafers that were plated required a seed layer for the plating process to be conducted.
Q. Did the experiments involve characterizing the seed layers or seed layer capabilities in any way?
MR. BROWN: Vague.
MR. MELNIK: Join.
THE WITNESS: I'm sorry. I don't

Page 75

recall. I would like to point out, though, that nothing in this document that seems to indicate that there was a characterization of seed layers, per se, in fact, very explicitly, we had initially concentrated on optimizing the process for thickness uniformity of the plated films.
THE REPORTER: Would you slow down? Optimizing?
THE WITNESS: Yes. It says explicitly, initially concentrate on optimizing the processes for thickness uniformity of the plated films, and secondarily, for maximum plating rate.
BY MR. RIEDINGER:
Q. So, did work on seed layers arise later --
MR. BROWN: Vague.
BY MR. RIEDINGER:
Q. -- as part of the characterization experiments?
MR. BROWN: Vague.
MR. MELNIK: Joined.
BY MR. RIEDINGER:
Q. You may answer.

Page 76

A. I do not recall whether this was contemporaneous or preceded the work on seed layers.
Q. Okay. Go to the next document.
MR. RIEDINGER: Would you mark this as the next exhibit, please?
THE REPORTER: Would you try to slow down, please?
THE WITNESS: Yes, I will.
MR. BROWN: Particularly when you are reading. People have a natural tendency to read things faster than you would say them.
(The document referred to was marked Taylor Exhibit-51 for identification.)
BY MR. RIEDINGER:
Q. Mr. Taylor, the court reporter has marked as Exhibit 51, a three-page document having production numbers 009915 through 17, and that's now before you. Do you recognize Exhibit 51?
A. No, I do not.
Q. How about the first page, which appears to me to be some kind of organization chart for the Advanced Technology Group at

Page 77

Semitool. Do you recognize that?
A. I do not.
Q. Have you -- do you recall seeing organization charts of this kind when you were at Semitool?
A. I do not.
Q. There is a date in the lower right corner, April 9, 1997. And I see your name in a circle with the word "seed layer" above it. Do you see that?
A. Yes, I do.
Q. In April of 1997, did you have responsibilities within the Advanced Technology Group relating to seed layers?
A. Yes, I did, but not exclusively related to seed layers.
Q. Okay. What aspect or portion of your responsibilities in 1997 -- April of '97 at Semitool related to seed layers?
A. This organization chart notes that ECD has a name of Chris Haugan; underneath it, Tom Ritzdorf and Dr. Chen. It also has bubbles on field and external field issues, Bob Batz and Lab Manager, Customer Demo Jeff Turner.

Page 70

important -- or what I considered to be critical process parameters on the final plating process result and that we insufficiently understood the responses to these various input parameters such as flow, rotation, anode/cathode separation, and anode/diffuser separation.

Q. When did you decide to make the recommendation that's in Exhibit 50?

A. The only date that I can refer you to is the date that this was issued, October 24.

Q. And, in fact, were a series of experiments conducted to lead to characterization and optimization of, among other things, copper electroplating processes?

A. There were certainly a series of experiments run during the period of time that I was run at Semitool. I do not recall the exact results of this particular recommendation, but there were a series over the course of the two-plus years that I was there that examined these parameters and the results on the plated film.

Q. Did you subsequently have any role

Page 71

in the conduct of experiments to characterize copper electroplating -- electroplating processes at Semitool?

A. Absolutely, yes.

Q. What was that role?

A. The role was in -- as suggested by this document in designing these experiments, and then subsequently analyzing them, discussing with the engineers the impediments that they might have encountered in conducting them, helping to allocate resources, resolve priorities --

Q. Okay.

A. -- functioning as the Manager of Process Development.

Q. Did any of those characterization experiments relate to seed layers -- copper seed layers?

A. Some of those experiments related to attempting to produce the best possible fill on a variety of seed layers, yes.

Q. And did the characterization experiments involve work with other companies -- companies other than Semitool?

A. Yes.

Page 72

Q. What companies were those?

A. Comprehensive list, I don't recall, but they certainly involved Intel, AMD, Motorola. We performed experiments for Fujitsu. We performed experiments for NEC, and those are the only ones that I have immediate recollection of.

Q. Did you have any role in dealing with or interacting with people at those other companies: Intel, AMD, Motorola, Fujitsu, NEC?

A. Yes.

Q. And what was your role?

A. My role was in working with them to identify what their success criteria were, what problems that they were currently experiencing, what they considered to be their desired outcome of experimentation, logistics on availability of substrates, details of how those substrates were manufactured prior to processing at Semitool, details of the experimentation to be conducted at Semitool, analysis of the results of that experimentation.

Q. Would you say that you were the

Page 73

principal point of contact with each of those companies for those characterization experiments?

A. Not -- that would be too broad of a statement. I was one of the points of contact.

Q. Were you one of the main points of contacts?

A. Yes.

Q. Who else would you say, if anyone, was a main point of contact?

MR. BROWN: It's vague as to time.

BY MR. RIEDINGER:

Q. For the characterization experiments.

A. Certainly, Tom Ritzdorf was one of the principal points of contact. Occasionally, individuals such as Bob Batz or Jeff Turner would have a lead role in direct interfacing with the customers, particularly when discussing logistics and availability of substrates, et cetera, timing of experiments.

Q. And could you briefly tell me what is shown in a general fashion on the last two pages of Exhibit 50?

Page 82

exhibit?
(The document referred to was marked Taylor Exhibit-52 for identification.)
THE WITNESS: Thank you.
BY MR. RIEDINGER:
Q. Now, Mr. Taylor, the court reporter has marked as Exhibit 52 a one-page document having production numbers 001833, and that's before you. Do you recognize Exhibit 52?
A. No, I don't.
Q. The subject of Exhibit 52 is a meeting -- Intel meeting Monday, April 28th. Do you have a recollection of a meeting with Intel at the end of April 1997?
A. I do not have a recollection of meeting with Intel specifically at the end of April of 1997.
Q. If you look at the box that appears in the middle of the page of Exhibit 52, there is a reference to San Jose, Bob Berner, Tom Taylor, Chris Haugan and -- excuse me -- Tom Taylor, Chris Haugan and Jeff Turner. Then, it has times to depart Kalispell and a time for departing San Jose. Do you have a recollection of the

Page 83

four of you at any time going down to San Jose for a meeting with Intel?
A. Yes.
Q. What is your recollection?
A. My recollection is that we had a discussion with Intel on the potential for engaging Intel's capability in modeling for possible application in reactor design.
Q. And what do you mean by modeling?
A. Modeling such as computational fluid dynamics or the computational methods to determine the distribution of electric field flux within a reactor containing conductive electrolyte.
Q. Okay.
A. They had -- please excuse me. They had experience in modeling low pressure reactors and were interested in determining whether their expertise could be generalized to something like a plating.
Q. Who did you meet with at Intel?
A. I don't recall.
Q. Do you recall bringing any materials with you to present to Intel?
A. No, I don't.

Page 84

Q. And the reason I asked that is that Exhibit 52 in the paragraph under the word "Chris" is suggesting that Mr. Haugan should bring foils on the material he's been working on.
Does that refresh your recollection that perhaps some foils were brought down to Intel and presented?
A. I don't remember.
Q. Do you have a recollection of Mr. Haugan doing any work as part of characterization experiments in April of 1997?
A. I do not.
Q. Do you have any idea whether Mr. Haugan may have presented information regarding characterization work to Intel at any time, April or otherwise, within 1997?
A. My recollection is obviously not specific. I do recall that we had the discussion with Intel on modeling and on possible applications to reactor design. I do not recall whether Chris Haugan actually made that presentation.
Q. Do you recall making presentations to Intel at any time -- you personally making

Page 85

presentations to Intel at any time in the first half of 1997?
A. I remember detailed technical discussions. I do not recall presentation format, but I do certainly recall discussions in which Intel and Semitool engineers had cross the table working discussions that I was involved in.
Q. Who were the Intel people who were involved --
A. The individuals that I've noted in my previous deposition and were Chun Mu and a gentleman named Shu Jin.
Q. Did your discussions with Mr. Mu and Mr. Jin involve characterization experiments?
A. Could you clarify that, please? What do you mean by characterization experiments?
Q. Well, as that phrase is used in Exhibit 50, did they involve the kinds of characterization experiments that are described in Exhibit 50?
A. Yes.
Q. And did they also involve

Page 78

Both of those bubbles are connected to the one that includes my name. My scope of responsibilities included the ones that are identified under field or -- excuse me -- process external field issues. The responsibilities noted under "Lab Manager DOE Customer Demos" but also included Core ECD Technology Development, which includes the bubble showing Tom Ritzdorf and Dr. Chen.

Q. There are several names that appear on the first page of Exhibit 51 aside from yours. Did any of the people listed on that page report directly to you in April of 1997?

A. Any of the people -- I was completing performance appraisals and directing the work of individuals that I have just noted, which involved Tom Ritzdorf, Dr. Chen, Bob Batz, Jeff Turner. There was -- there were a number of managerial changes that were taking place at Semitool during the period of time in which Advanced Technology Group was, in some cases, treated as a division, and in other cases, not. And the period of time in which this organizational chart is dated my recollection is that was one of the periods

Page 79

in which the corporate structure was in flux. I do not recall ever having seen this sleet.

Q. Okay. Mr. Haugan -- Chris Haugan, was he a person who, in April of 1997 was at least to some extent, under your supervision?

A. I don't recall having directly supervised Chris Haugan.

Q. And I am not sure I understood one of your earlier answers. Aside from yourself, were there other people who are listed on the first page of Exhibit 51 who had some responsibility in the seed layer area within the Advanced Technology Group?

A. In that particular period of time, I don't recall who else might have had responsibility for seed layer. I don't even recall specifically whether there were any detailed engineering efforts being expended on seed layer.

I do know that at that period of time, we had identified the ability to do an electrolytic seed layer as being a desirable technical thrust, but whether there were any programs underway specifically at that time, I don't know.

Page 80

Q. Okay. So, why don't we talk about the period that's the first half of 1997 -- beginning in 1997 through the end of June.

Either by reference to Exhibit 51 or without referring to it, can you tell me who were the individuals within the Advanced Technology Group that you recall were involved in the seed layer work?

A. I'm sorry. I don't remember specific programs underway on seed layer at that time.

Q. Any time in the first six months -- first six months of 1997?

A. I don't recall any specific programs that were underway during that period of time.

Q. Okay. Well, perhaps we can refresh your recollection as we look at some more documents.

And by the way, this notebook is available for you to review at any time and it does have, I think, in reverse chronological order, a number of these same documents. Perhaps, the context might help you out. And if you feel the need to look

Page 81

at it, feel free to do so.

A. That's a rather thick document. Would it be best for me to go off-line and read it prior to continuing this discussion?

Q. I don't think so. Only if there is a particular thing that you think that might -- your recollection might be refreshed by seeing a particular document, it might well be in there.

Most of these documents that we're going through today are in there. And if you want to see them in context, you are welcome to. I'm not asking you to read it.

MR. BROWN: I think I object to you suggesting that he should refresh his recollection before answering any question by going through this two-inch binder, but if you want to show him some particular documents, that's fine. If he needs to see context, and then you show him the binder that makes sense also.

MR. RIEDINGER: Of course, that was not my suggestion. I was merely saying it's available if he wants to.

Could we mark this as the next

Page 90

the record that, while it does not bear the same Bates range, it appears to be the same memo that was previously marked as Exhibit 1052.

MR. MELNIK: During the Stevens deposition.

THE WITNESS: Nothing substantive is inaccurate, only some of the somewhat whimsical comments about loving to be shown experimental observations that I can't explain, but nothing that's -- nothing that's substantial is inaccurate.

BY MR. RIEDINGER:

Q. Thank you. Does -- would you call this a memo, Exhibit 53?

A. I have no idea what the definition of "memo" is.

Q. This is a document -- does Exhibit 53 relate to the characterization experiments that are described in Exhibit 50?

MR. BROWN: Vague.

THE WITNESS: This is a communication between myself and Chun Mu describing a proposal to conduct certain experiments.

Page 91

BY MR. RIEDINGER:

Q. But what I'm trying to determine is if these experiments that are described in Exhibit 53 were parts of that characterization process that was described in the October 24, 1996 memo to Tom Ritzdorf.

MR. BROWN: It's vague and compound.

MR. MELNIK: Join.

THE WITNESS: This set of experiments is not connected in a direct way with the experiments that were suggested in October of 1996. This was a separate effort.

BY MR. RIEDINGER:

Q. Did the experiments that are described in Exhibit 53 evolve from what's described in Exhibit 50, the October 24th memo?

MR. BROWN: Vague.

THE WITNESS: Did it evolve from it? At the time that this proposal was made --

BY MR. RIEDINGER:

Q. You are referring now to Exhibit 53?

Page 92

A. -- to the May 1, 1997 document. I do not recall having referred explicitly back to any results that were obtained from October 24th, 1996 experimental plans.

Q. Here is my question, and I'm probably expressing it very inartfully. It occurs to me that perhaps the series of experiments that are discussed in Exhibit 50 over time resulted in more experiments, whether they specifically were referred to in one memo or another.

So, is Exhibit 53 a continuation -- does it describe experiments that are a continuation of the experiments of Exhibit 50?

MR. MELNIK: Objection, asked and answered.

MR. BROWN: Vague.

THE WITNESS: In some cases, the experiments identified in the May 1, 1997 memo, Exhibit 53, refer to process parameters that are similar to those identified in the previous experiment. That doesn't imply that the results of the experiments described in Exhibit 50 were the predecessors of any experimental design described in experiment

Page 93

(sic) 53.

The answer is, the best of my ability to do so, is no. The experiments described in Exhibit 53 were not made in reference or an extension of the experiments described in Exhibit 50.

BY MR. RIEDINGER:

Q. Part of the reason I'm asking that is because Exhibit 50 refers to Experiments 1 and 2, and Exhibit 53 is Experiments 5 and 6. And I wonder if they are 5 and 6 in the same series.

A. No. In this case, Experiment 5 and 6 referred to experiments that were conducted specifically with Intel's involvement.

Q. Okay. So, is it correct to say that exhibit -- Experiments 5 and 6 as described in Exhibit 53 were 5 and 6 in the series of experiments with Intel?

A. Yes, that is the best of my recollection.

Q. Are Experiments 5 and 6 described in Exhibit 53 characterization experiments?

MR. MELNIK: Vague.

Page 86

characterization experiments relating to seed layers?
A. They certainly involved characterization experiments on attempting to produce the best fill on Intel seed layers.
Q. Okay. And what was your role in those characterization experiments that were attempting to produce the best fill on Intel wafers?
A. My role was specifically in discussions with Chun Mu is attempting to identify what factors might influence the success of the fill. Also, emphasizing to Chun Mu that the seed layer was an important input to determining success.
We had requested that Intel provide us with cross-sections of their seed layer prior to plating so that we could identify whether those seed layers were continuous, evaluating different plating parameters in an attempt to fill on their seed layers, and then ultimately, an attempt to do a -- an electroless process prior to electrolytic copper deposition.
Q. What was the purpose of attempting

Page 87

to do an electroless -- electroless process before doing the electrolytic deposition?
A. The attempt was to supplement the existing seed layer prior to electrolytic process in an attempt to eliminate some of the voiding that had been previously observed in earlier experiments.
Q. Why were you doing that?
A. For the reasons just stated: As an attempt to determine whether we could avoid some of the voiding that had been observed in previous experiments.
Q. What was your personal role in the attempts to determine the -- let me step back.
MR. RIEDINGER: Would you read his last answer back, please?
(Record read.)
MR. RIEDINGER: Thank you.
BY MR. RIEDINGER:
Q. So, what was your personal role in the attempt to determine whether one could avoid some of the voiding that had occurred in previous experiments?
A. Working with Intel to conceptualize

Page 88

what parameters could be pursued, discussing the viability of different approaches, designing the subsequent experiments, identifying the number of wafers required that Intel would have to provide.
Q. Anything else that you can recall?
A. Analyzing the results at the conclusion.
Q. Let's go on to the next exhibit.
MR. RIEDINGER: If you could mark this as the next one, please.
(The document referred to was marked Taylor Exhibit-53 for identification.)
MR. BROWN: 53.
MR. RIEDINGER: Thank you.
BY MR. RIEDINGER:
Q. Mr. Taylor, the court reporter has marked as Exhibit 53, a four-page document having production numbers 003081 through 84, and that exhibit is now in front of you.
Do you recognize Exhibit 53?
A. Yes, I do.
Q. Did you write Exhibit 53?
A. Yes, I did.
Q. What is Exhibit 53?

Page 89

A. Exhibit 53 is entitled Experiment 5 and 6 Proposals. This is a communication between myself and Chun Mu of Intel.
Q. Is that your signature that appears on the first page of Exhibit 53?
A. Yes, it is.
Q. Did you write all of Exhibit 53?
A. Yes, I did.
Q. When was the last time that you recall seeing Exhibit 53?
A. Prior to the last deposition.
Q. You reviewed materials in advance of the last deposition?
A. This was provided to me in advance of the last deposition.
Q. And you haven't looked at the document that's Exhibit 53 since then?
A. That's correct.
Q. Is there anything that's stated in Exhibit 53, as we sit here today, that you believe is inaccurate?
A. If you will allow me to read it once again, I will tell you in a moment.
Q. Please do.
MR. BROWN: Let me just note for

Page 98

defined."
Q. Yes. It refers to experiments intended to increase our mutual knowledge of the mechanisms at work.
Are those experiments described anywhere in Exhibit 53?
A. I believe that these refer to the final page 3 of 4 and 4 of 4 that describe what is labeled as Experiment 5 and Experiment 6.
Q. Okay. When did you agree to define experiments?
A. I recall having agreed to define experiments during the meeting that this -- that in which those film morphology results were -- that I described earlier were discussed.
Q. Do you have any recollection of the conversation -- the specific conversation at the meeting?
A. I do not.
Q. You said pages three and four. Does page 2 of Exhibit 53 describe the experiments that are defined?
A. They also describe the experiments

Page 99

that were defined in tabular form on pages three and four of this exhibit.
Q. Okay. What did you do -- what steps did you take to define the experiments that are on pages 2, 3 and 4 of Exhibit 53?
A. I'm very sorry. I don't understand. The reason I don't understand is because this seems extremely explicit as it stands. What steps did I take?
I identified, as indicated here, what the intention was, what the structure of the wafers would be, what chemistries would be employed, and what parameters would be evaluated.
Q. Did you simply sit down and write what's shown on pages 2, 3 and 4 of Exhibit 53?
A. After significant thought, yes.
Q. So, is it correct to say you thought about it and then wrote it?
A. Yes.
Q. Did you consult any document or any person in writing them?
A. I don't recall having done so.
Q. So, if we look at Experiment 6

Page 100

that's on page 2 of 4 in Exhibit 53, does the first line describe the purpose of Experiment 6?
A. Yes, that's the intent of that line to describe the purpose of Experiment 6.
Q. Experiment 6 refers to step coverage. What is your understanding of step coverage, as you use the term in Exhibit 53?
A. In this case, step coverage refers to the uniformity of thickness of the seed layer from the top to the bottom of an inlaid structure.
Step coverage would typically be expressed as a ratio of the thickness at the -- of the bottom of the structure to the thickness at the top of the structure.
Q. Is there such a thing as a step that's being covered?
A. That is the -- that is exactly correct. In this particular case, an inlaid structure has a -- is referred to as a step, or as an example of a step.
Q. In other terms, is it correct to say that a step would include structures such as trenches or vias?

Page 101

A. Yes.
Q. So, the first line under Exhibit (sic) 6 says, "Determine if marginal PVD seed layer step coverage can be improved by supplementary electroless deposition."
What was intended to be supplementary about the deposition?
A. The electroless deposition of copper to supplement the presumed marginal PVD seed layer.
Q. What was marginal about the seed layer, or what was presumed to be marginal?
A. Presumed to be marginal was the likelihood and the observation in previous experiments that the seed layer was so thin at the bottom as to become intermittently discontinuous or so thin so that the plating results were indistinguishable from having a discontinuous seed.
Q. And what kind of improvement were you looking for?
A. I was looking to have a fill result that did not have voids associated with the side wall of the structure that we presumed were due to discontinuous PVD seed

Page 94

THE REPORTER: What was the objection?
MR. MELNIK: Vague.
MR. BROWN: Join.
THE WITNESS: These experiments were intended to evaluate the response in copper fill to a number of input parameters. In that sense, they -- characterizing the results on the basis of the set points. So, yes, they are characterization experiments.
BY MR. RIEDINGER:
Q. At the top of the Exhibit 53, the May 1, '97 memo, refers to Metallization Process Group. What was the Metallization Process Group?
A. The Metallization Process Group was one of the terms by which the team working on electroplating was referred. Advanced Technology Group was one of those.
ECD Division was another. As I think I may have mentioned, there was a number of organizational changes that were taking place during that period of time, and I do not recall exactly how long each of those iterations lasted or even necessarily

Page 95

what the full scope of the changes were.
The Metallization Process Group was the group of people who were working on, particularly, electroplating.
Q. Do you know if, in May of '97, the Metallization Process Group was part of the Advanced Technology Group?
A. I do not recall whether the Metallization Process Group was a replacement for, was a subset or superset of the ATG.
Q. Who managed the Metallization Process Group?
A. At that period of time, I believe it would have been Bob Berner.
Q. And what, if anything, was your role within or with either one of the Metallization Process Group?
A. In May, I would have been -- I believe, I would have still been working as the Manager of Process Development, but that was very close to a period of time in which I chose to take a job as the Technical Marketing Director.
I do not recall whether May 1 was before or after that period of time.

Page 96

Q. In the body on the first page -- the body of text on the first page of Exhibit 53, the first line says, "Thanks for hosting yet another fascinating meeting."
Do you know if the meeting that's referred to in that line is the meeting that's referred to in Exhibit 52?
A. It was not. It was not. To the best of my recollection, it was not.
Q. What meeting is referred to in the first line of Exhibit 53?
A. My recollection is that Intel, Chun Mu in particular, provided us with a series of very well executed cross-sections of wafers that were -- represented the evolution of the copper deposition sequence from initial plating through complete plating and was able to, not only display the discreet photos, but also through electronic manipulation, show them as -- a an overlay so that it was possible to visualize how the film morphology was developing.
And I do not recall that meeting being in concert with a meeting that had anything to do with reactor modeling.

Page 97

Q. Where did that meeting occur?
A. We had meetings on this topic in both Santa Clara and in Kalispell. I do not recall where this one took place, but I seem to remember -- please excuse me on the vagueness -- that there were actually two meetings on this topic, one in Santa Clara and then a subsequent one in Kalispell.
So, I do not -- that these same photographs were discussed. So, on May 1, I don't recall whether I would have been referring to a Santa Clara or a Kalispell meeting.
Q. Does the reference to hosting a meeting suggest that the meeting took place at Intel --
A. That suggests that, yes.
MR. BROWN: Again, you need to let him finish his question.
THE WITNESS: I'm very sorry.
BY MR. RIEDINGER:
Q. I would like to skip down to the third paragraph -- begins, "As agreed, I have roughly." Do you see that?
A. "As agreed, I have roughly

Page 106

page of Exhibit 53. The reference to second experiment. Is that Experiment 6?
A. That's what is intended here. That is correct.
Q. And it also refers to a short electroless deposition. How short is "short"?
A. As intended here, this electroless copper deposition thickness targets were between 500 angstroms and 1500 angstroms. That's what was -- I was referring to a processed or a thickness that was insufficient to necessarily fill the inlaid structures independently -- independent of a subsequent electrolytic process.
Q. So, it's a short thickness as opposed to a short amount of time?
A. Short time in order to produce a small thickness.
Q. Do you have any recollection of the amount of time?
A. No, I don't.
Q. Did you even have a concept as to the amount of time at the time that you wrote Exhibit 53?
A. I knew that the electroless

Page 107

processes varied significantly in their deposition rates, but we would anticipate deposition rates on the order of a couple of hundred angstroms per minute. So, yes, I had a concept that this would be a process that would take place over the range of between perhaps, one and ten minutes in that range.
Q. Thank you. If we go to page 2 of Exhibit 53. The seed layer refers to three thicknesses. The line seed layer under Experiment 6 refers to three thicknesses: 500 angstroms, 1000 angstroms, and 1500 angstroms.
Why those particular -- why were those particular thicknesses included in the experiment design?
A. I do not remember exactly which thickness Intel was using as their nominal value for wafers that they were submitting to Semitool for characterization work. However, I believe it was on the high end of that range. It was either 1000 angstroms or 1500 angstroms.
But the intention was to evaluate thinner films than their nominal specifically

Page 108

to precipitate circumstances where the seed layer would be discontinuous.
Q. And then that same line refers to thickness splits. What is a thickness split?
A. Thickness split. A split is a subset of an experiment. So, a thickness split would be ways of -- of -- please excuse -- parsing the experiment between groups of wafers that would receive, within those groups, a common set of parameters.
So, in this case, approximately a third of the wafers or one split of the experiment would receive one thickness; a third of the wafers, approximately, would be a separate split with a 1000-angstrom thickness, et cetera.
Q. So, since there were 45 wafers listed on page 4, there would be 15 in each of those thicknesses; is that correct?
A. I haven't counted this. There are reasons in some experimental designs that they won't be absolutely symmetrical in count, but that would be roughly correct. I haven't counted this actual experiment.
Q. Go to page 3 of Exhibit 53.

Page 109

There is some handwritten material. Do you recognize the handwriting?
A. No, I don't.
Q. So, it's not yours?
A. No, it's not.
Q. Do you recognize the subject that's described in the handwriting?
A. I know, in some cases, what it makes reference to.
Q. And what does it make reference to in those cases where you know?
A. The first line has DC and PR. In this case, "DC" means direct current. "PR" means pulse reverse. To the right-hand side of that, "FWD" means forward. Forward would be a process in which the plating current is pulsed but is not pulsed so that the wafer is alternately anodic and cathodic. It would be strictly cathodic, which is referred to as forward pulsing. 6.8 and 9.0, though I don't know for a fact, probably refer to the maximum current: 6.8 amps and 9 amps in the plating cell.
The next line, it says, "5 baths." That would refer to the 5 bath types that

Page 102

layers.
Q. Do you recall describing or discussing Experiment 6 or the concept of Experiment 6 at any meeting with the people at Intel?
A. You know, I don't recall having discussed it with them explicitly. I don't recall that.
Q. If we go back to the first page of Exhibit 53, the fourth paragraph, the paragraph that begins, "The first experiment is directly related."
A. Yes.
Q. The second sentence -- I'll just read it to you -- reads: "The second experiment is related to my proposal to supplement the step-coverage of PVD seed layers by a short electroless copper deposition process prior to beginning electrolytic plating; if you are at all interested, we may choose to pursue this either immediately or at some later date."
So, that sentence refers to quote, "my proposal."
A. Yes.

Page 103

Q. Do you recall making that proposal?
A. I -- that's -- the short answer is no.
Q. Do you recall any discussions with people at Intel at all about such a proposal?
A. Any recollection that I have is extraordinarily vague. I seem to recall -- I recall it very vaguely, yet again having endorsed an idea with Intel that we should attempt to produce better fill results by augmenting their seed layer by doing an electroless process, but I do not recall the specific conversation.
This sentence is ambiguous in that it doesn't necessarily refer to previous discussions on the topic -- only my proposal.
Q. When is the first that you heard of supplementing step-coverage of PVD seed layers with a short electroless copper deposition process?
MR. MELNIK: Objection, vague and ambiguous.
MR. BROWN: Join.
THE WITNESS: I don't remember when the first time that I heard of it was.

Page 104

In fact, I do not recall whether or not there had -- whether I had, in fact, come across the concept through other work or had conceptualized this either independently or with my colleagues at Semitool before having run across any other reference to it. I do not recall the first instance.
BY MR. RIEDINGER:
Q. Do you recall discussing that subject with anyone before May 1 of 1997 before you wrote this memo?
A. Oh, yes. In fact, I can recall several discussions with Tom Ritzdorf, with Jeff Turner mostly in reference to experimental or customer demo results in which voids were observed that we concluded were associated as much with the limitations of the seed layer than with the plating process and our discussions as to what we could do to possibly ameliorate that mostly so that our plating process demo results didn't look inadequate.
Q. When did your discussions with Mr. Ritzdorf and Mr. Turner take place?
A. Prior to May 1st of 1997 and after

Page 105

my date of employment. I don't recall exactly.
Q. Can we try to put some range on it? Was it in 1997, for example?
MR. BROWN: Asked and answered.
THE WITNESS: Sorry. I don't remember the specific time frame. I don't recall whether it was the end of '96, beginning of '97.
BY MR. RIEDINGER:
Q. Could you just refresh my recollection? I know you were asked this question at the last deposition, but when did you start working at Semitool?
A. You know, I recall when -- as a matter of fact, this was something that had been asked several times, and I have not, in the meantime, gone back and taken a look at my tax records.
I do not remember exactly what my date of employment was, but that's something that you should have access to.
Q. Sometime -- well, we can find that date. I would like to go back to the second sentence in the fourth paragraph, the first

Page 114

(sic) 6 other than the people listed on the front page of Exhibit 54?
A. There was -- there was no intention to exclude anyone who was in the group at the time. So, I would have made individuals such as, Dr. Chen familiar with the results that I had --
Q. Anyone else --
A. -- that Intel had obtained. Anyone else specifically? No, I don't recall.
Q. Let's go back to Exhibit 1053. The second page is headed "Experiment 6." Is that the same Experiment 6 as referred to on the second page of Exhibit 53?
A. I'm sorry. I want to make sure I understand. Experiment 6.
Q. Are the two references to Experiment 6 that are contained on the second page --
A. Yes, that would have been the same -- the same experiment. That's correct.
Q. Is it possible that a cut and paste process with a word processor was used to prepare either the reference to exhibit

Page 115

(sic) 6 on Exhibit 53 or the reference to exhibit (sic) 6 on Exhibit 1053?
A. 1053. Sorry. The reference to exhibit (sic) 6 in which two locations, please?
Q. The second page of 1053 and the second page of 53. In other words, is one cut and pasted from the other?
A. Yes, I would say that that's true.
Q. Is that your signature on the bottom of the second page of Exhibit 1053?
A. Yes, it is.
Q. And is it also your signature on the third page of the bottom -- of the bottom of the third page of Exhibit 1053?
A. Yes, it is.
Q. And if you go to the last page of Exhibit 1053, was that a document that was presented at an Advanced Technology Group meeting?
A. I do not recall having made that specific presentation.
Q. Do you recall if anyone else made the presentation using this document?
A. I do not recall.

Page 116

Q. Why did you sign the second and third pages of Exhibit 1053?
A. I don't know.
Q. Was that a common practice? Was that -- did you commonly sign documents of this kind?
A. I commonly did, yes.
Q. And why did you commonly do it?
A. Simply to acknowledge that I had been the author of it.
Q. And the third page of Exhibit 1053 has some handwritten notations. Do you recognize those handwritten notations?
A. The third page --
Q. On the top.
A. Yes, that is in my handwriting.
Q. And what do they mean?
A. They -- they mean that, in this particular case, the work to evaluate electroless copper supplement on PVD seed layers would be pursued with substrates obtained from Intel and that for CVD seed layers would be obtained on substrates obtained from LETI.
THE REPORTER: From what?

Page 117

THE WITNESS: L-E-T-I. L-E-T-I.
BY MR. RIEDINGER:
Q. And were experiments to evaluate electroless copper supplement of CVD seed layers on wafers obtained from LETI actually conducted?
A. I don't recall. I know -- what I do recall is that we had significant difficulty in obtaining wafers from LETI, and whether this particular experiment was conducted is -- I do not remember.
I do not recall having reviewed results from the execution of this experiment.
Q. And the third page of Exhibit 1053 has a date in the lower right corner, May 1, 1997?
A. On the third page? Yes.
Q. Does that mean that the document -- the third page, at least, was prepared on May 1 of 1997?
A. That is possible, but it's also possible that this was cut and paste with modifications indicating CVD rather than PVD seed layer and that the date was not updated. I do not know which of those two cases

Page 110

are enumerated starting from what is in quotations of "STI Basic Bath," and then extending through one that says, "Copper Bath M with all additives brighteners and levellers."

Q. All right. Let's go on to the next exhibit. Mr. Taylor, I'm going to hand you -- or I have just handed you a copy of what was previously marked as Exhibit 1053, which is now before you. Do you recognize Exhibit 1053?

MR. MELNIK: There appears to be some text blanked out on page 16468 on the right-hand side.

MR. RIEDINGER: Yes. That appears to be the case, and I have not been able to find any copy that does not have that text blanked out.

THE WITNESS: I do recognize it now. I hadn't recalled this before, but this does refresh my recollection. So, yes, I do recall this.

BY MR. RIEDINGER:

Q. Did you write Exhibit 1053 or any portion of it?

Page 111

A. I did write, certainly, the pages -- I'm not sure how to refer to these pages, but in this packet that I have been handed, the second and third page and don't recall having written the last page.

Q. Do you recognize the last page?

A. Yes, I do.

Q. What is the last page?

A. The last page is a list of experiments related to -- it's entitled and relatively clear, Barrier and Seed Layer Development.

MR. RIEDINGER: Let's mark another exhibit and perhaps it can connect them together. Would you mark this as the next exhibit, please?

MR. BROWN: It's 54.

(The document referred to was marked Taylor Exhibit-54 for identification.)

BY MR. RIEDINGER:

Q. Mr. Taylor, the court reporter has marked as Exhibit 54, a single paged document having production number 016466, and it's now in front of you. Do you recognize Exhibit 54?

Page 112

A. No, I don't.

Q. Do you recognize the format of Exhibit 54?

A. Yes, I do.

Q. It's titled "Agenda." Did the Advanced Technology Group have agendas of this sort prepared before meetings of the group?

A. Occasionally.

Q. There are a list of presenters under the heading "Agenda," including your name. And next to your name is the statement "Seed/barrier layer develop."

A. Yes.

Q. Do you see that?

A. Yes.

Q. Does that relate in any way to the final page of Exhibit-1053?

A. I believe it does.

Q. How does it relate?

A. I believe that the experiments that are described in Exhibit 1053 were the scope of work taking place on barrier and seed layer development that would have been discussed in this meeting of May 2nd.

Q. Did you present information to the

Page 113

Advanced Technology Group at any meeting that you recall regarding the Experiment 6 that's described in Exhibit 1053?

A. I don't recall -- do I recall? I do not recall the specific circumstances. I do know that I disseminated the information, summarized it and disseminated it, but -- so, I don't recall having done it at this specific meeting, but yes, I do.

Q. Did you disseminate it to the Advanced Technology Group?

A. Yes.

Q. And did that include the people who were on -- listed on the front of Exhibit 54?

A. Yes.

Q. Anyone else?

A. I don't recall who were -- who were the attendees at either this meeting that's explicitly shown in Exhibit 54 or in a meeting in which I would have disseminated the information from Experiment 6.

Q. Okay. So, are you able to identify any other persons that you believe received the information regarding exhibit

Page 122

remember making this specific presentation.
Q. If you turn to the third page, the page headed "Seed Layer Optimization."
A. The third page. One, two, three. Seed Layer Optimization, yes.
Q. What is intended to be meant by optimization?
A. Optimization is intended to mean the methods by which existing vacuum deposition methods could or should be optimized for subsequent copper deposition.
Q. And by "vacuum deposition methods," are you referring to PVD and CVD?
A. Yes.
Q. Okay. Under "Major Issues" on that same page, there is a reference to step-coverage. What does that refer to?
A. That refers to as described earlier, the attribute of vacuum deposited films to have varying thicknesses from the top to the bottom of inlaid structures.
Q. Does the presentation on April 4 of 1997 represent one of those discussions that you mentioned earlier that you had about the subject of step-coverage with other people

Page 123

at Semitool?
A. It falls into that category, yes. I certainly could. Again, I do not recall having the circumstances of actually standing in front of my peers and making this presentation.
Q. Do you recall having discussions of seed layers step-coverage before the April 4, 1997 presentation?
A. I recall that the topic of step-coverage and its impact on success of electrolytic deposition would have been a topic prior to April 4.
Q. Okay. When do you recall the subject of step-coverage and its impact on electrolytic deposition being first discussed at Semitool?
A. I don't recall exactly when it was first, but certainly prior to this time frame.
Q. Let's turn to what, I guess, is the fourth page -- the fifth page, production number 010012 entitled "Seed Layer Enhancement."
What did you mean when you used

Page 124

the term "enhancement" in the title of that slide of that foil?
A. What I meant was a process by which a preexisting seed layer could be supplemented by a wet chemical process prior to anisotropic electrolytic deposition.
Q. Did you say a preexisting sub-layer or seed layer?
A. Seed layer is what I said.
Q. Thank you. So, the rest of the discussion on the fifth page, the page entitled Seed Layer Enhancement deals with -- is it correct to say that it deals with the process for supplementing a preexisting seed layer?
A. Yes, and I'm going to refer to the third sub-bullet of the first section. It says, "Initial Seed Layer Requirements 200 to 500 angstroms."
Q. And why do you refer to that?
A. Because it is pertinent to your question that this does, in fact, refer to processes that imply the presence of a previous seed layer.
Q. So, the reference to an "Initial

Page 125

Seed Layer Requirements 200-500 angstroms" means that the preexisting seed layer was between 200 and 500 angstroms thick?
A. Anticipated to be in that range.
Q. And then that seed layer would be supplemented?
A. That is correct.
Q. How would it be supplemented?
A. By either the electroless copper method on thin PVD and CVD copper seed, or alternatively and more speculatively, by modified electroplating processes.
Q. And after the supplementation, how thick would be -- how thick would the seed layer be?
A. That's not identified here, but in -- are you asking for my recollection of what we were anticipating at the time?
Q. It's not clear what I was asking, is it? Let me try again and ask a better question.
In the seed layer enhancement process that's described on the fifth page of Exhibit 56, what, if anything, was the expected ultimate thickness of the seed layer

Page 118

pertains.
Q. Okay. If we go back to Exhibit 53, look at the fourth page. I would like you to compare Exhibit 53, page 4, to Exhibit 1053, page 3.
Is one or the other cut and paste to form the other?
A. No, because the post processing sections are different.
Q. Okay. The final page of Exhibit 53 has a date May 1, 1997. Does that mean that that page was prepared on that date?
A. I don't know.
MR. RIEDINGER: Let's take a break.
THE WITNESS: Okay.
(Off the record.)
BY MR. RIEDINGER:
Q. Mr. Taylor, the court reporter has marked three more exhibits. I have placed them all before you. They have been marked as Exhibit-55, 56 and 57. I'm putting them before you to see if we can identify some of those earlier conversations that you mentioned in your testimony earlier today.

Page 119

Exhibit 55 is a single page document having production numbers 001823.
Exhibit-56 is a document having production numbers 01008 through 0014.
And Exhibit-57 is a multi-page document having production numbers 09884 through 9901.
Let's start with Exhibit 55. Do you recognize Exhibit 55?
A. No, I don't.
Q. Your name is listed in the "to" list --
A. Yes, I understand.
Q. -- I guess, the fourth person?
A. This absolutely looks similar to literally hundreds of documents of this nature that I received, but I don't recognize this one specifically.
Q. Do you recognize the format --
A. Yes.
Q. -- of the document as an agenda?
A. Yes.
Q. Were agendas typically prepared in formats like this before meetings of the Advanced Technology Group?

Page 120

A. Yes.
Q. Did you have the same position in the beginning of April that you previously described -- position where you were in charge of managing Process Development?
A. Yes.
Q. There is a reference in the agenda under the heading "presentations to team leaders." What was a team leader?
A. Team leader. In this particular case, these individuals would have had a focus project that they were overseeing and pulling resources, as required, whether from direct reports or distributed through the Advanced Technology Group to focus on these specific technology thrusts.
Q. Were you a team leader in April of 1997?
A. Yes.
Q. Were you a team leader for seed layer development?
A. That's correct.
Q. Do you believe that you gave a presentation regarding seed layer development at an April 4, 1997 meeting?

Page 121

A. I believe that I did.
Q. Could you take a look at Exhibit 56? Do you recognize Exhibit 56?
A. Yes, I do.
Q. What is Exhibit 56?
A. Exhibit 56 is a presentation on the topics of barrier, and seed layer, and integration concerns with copper deposition.
Q. Did you prepare Exhibit 56?
A. I believe I did.
Q. All of the pages except the first page of Exhibit 56 have handwritten notations in the lower right corner. I think they are legible in the last three pages, at least. Do you recognize the handwritten notations?
A. Yes. My last name in my handwriting and the date.
Q. April 4th of 1997?
A. Yes.
Q. Does Exhibit 56 represent foils that you presented on April 4th of 1997?
A. I believe that's true, yes.
Q. Are they foils that you presented to the Advanced Technology Group?
A. I believe that's true. I do not

Page 130

Q. What is a strike bath?
A. As intended by me when I wrote this, a strike bath is conceptually a bath that is capable of nucleating on relatively non-conductive or low conductivity surfaces. It's a -- refers to a specific bath formulation and conditions of employing that bath specifically to nucleate on structures that might not otherwise -- structures and materials that might not otherwise.
Q. And how, if at all, would a seed layer be enhanced using the strike bath concept?
A. The intention would be to allow nucleation on regions of barrier that were incompletely covered by an initial PVD seed layer or CVD seed layer.
Q. And in the second bullet point under "Modified Electroplating" refers to Electrolyte/Plating Conditions Optimized for Early Film Growth. What does that refer to?
A. Again, somewhat speculative, but we knew and know today that the electrolyte formulation, whether it's the inorganic or the organic components, as well as, plating

Page 131

conditions such as, applied current density have an impact on whether a film is deposited conformally or whether it tends to exhibit a property called super fill. And the intention here was to explore ranges of electrolyte formulation and plating conditions that might allow us to deposit conformal films rather than anisotropically deposited films that would form a supplementary layer on the seed layer prior to a bulk deposition.
Q. Okay. The phrase, "Modified Electroplating," does that refer to an electrolytic process?
A. Yes.
Q. Let's go back to the electroless process in the first bullet point.
Did you believe that the electroless process would improve step-coverage on April 4 of 1997?
A. I believed that it would improve -- I believed that it would deposit a conformal film on the preexisting seed layer. I did not know whether it would improve step-coverage, per se.
Q. Did you believe that it would

Page 132

improve the performance of the seed layer?
A. I believed that it had attributes that had promised to do so and justified the resources to conduct experiments to explore it.
Q. And what made you think that the electroless deposition had attributes that might improve the seed layer performance?
A. Because it did not require as a prerequisite the applied current. It did not -- let me put it this -- that appropriately formulated electroless baths should be capable of depositing on an appropriately catalytic surface, whether that surface was continuously conductive or not, and that electroless processes have frequently been used for depositing metals on entirely non-conductive surfaces if they are prepared in advance. It's one of the means by which plating on plastics, as an example, is conducted.
So, it was a technical assessment that if we needed to deposit a thin film on an exposed and relatively conductive barrier that electroless was a candidate process for doing so.

Page 133

Q. Do you recall discussing the subject of depositing a conformal layer on seed layers with anyone before the April 4th, 1997 date?
MR. BROWN: Asked and answered.
MR. MELNIK: Join.
MR. RIEDINGER: It's a slightly different question. I'm talking about conformal layers now.
THE WITNESS: I recall that in the context of trying to determine how to resolve plating process faults associated with discontinuous seed layers that the concepts of using wet chemical processes to supplement those seed layers, those discussions had taken place prior to the time frame of -- that these foils were generated -- prior to the time frame where I had thought these particular bullet points. But the specific date or the individuals involved -- the only individual that I can say with some degree of certainty was involved in those discussions would have been Tom Ritzdorf who was principal -- was my peer with whom I shared virtually all technical insights, questions, et

Page 126

after the enhancement process?
A. Unfortunately, I can't recall what my estimates were at the time because they have been supplemented by the last five years of learning. So, I can't remember exactly what I had anticipated the final thickness target would be back in April of 1997. I know what I think they should be now, but that's not the right answer.
Q. Do you recall describing a seed layer enhancement process of the kind shown on page five of Exhibit 56 to the Advanced Technology Group?
A. I recall having distributed documents of the sort that we've referred to in previous exhibits that refer to specifically, electroless processes with target thicknesses of between 500 and 1500 angstroms.
Q. And is it possible that the seed layer enhancement process that is described on the fifth page of Exhibit 56 had the same target thicknesses?
A. Yes, it's possible.
Q. Are other thicknesses possible -- target thicknesses?

Page 127

A. Yes, other thicknesses are possible.
Q. What other target thicknesses are possible?
A. Thinner or thicker than the 500 to 1500-angstrom range.
Q. How much thinner and how much thicker?
MR. MELNIK: Objection, calls for speculation, asked and answered.
THE WITNESS: Down to anatomic thickness and up to the point where the feature is completely blocked by the deposited electroless copper.
BY MR. RIEDINGER:
Q. Actually, I was probably trying to ask a question that I didn't convey to you very well. At the time that this page was prepared, the seed layer enhancement page, I'm looking for a range, to the best of your recollection, of the target thicknesses that you considered to be what was within the seed layer enhancement concept described in that page.
A. To the best of my recollection --

Page 128

go ahead.
MR. MELNIK: I'm sorry. Objection, asked and answered, calls for speculation. Thank you.
THE WITNESS: To the best of my recollection, the range of 500 to 1500 angstroms was the target range for purposes, not only of anticipated benefit to the structure, but also the range of control of the process.
To the best of my recollection, I do not remember that we believed or I believed that we could reliably produce films of less than 500 angstroms with the processes that were available to us at the time.
BY MR. RIEDINGER:
Q. Target thickness?
A. Target electroless thickness.
Q. And after the electroless deposition, did you contemplate that there would be a subsequent electrolytic deposition?
A. Yes.
Q. Did you call that "bulk fill"?
A. I have frequently referred to it as "bulk fill."

Page 129

Q. The same page -- the Seed Layer Enhancement page has a bullet point -- a sub-bullet point. It says, "Less Sensitive to Initial Seed Layer Discontinuities."
Do you have a recollection of what that refers to?
A. What this means is that electroless depositions of a supplementary film should be less sensitive to the initial seed layer discontinuities than an alternative electroplating process which relies upon, to some degree, the conductivity of either the barrier or the seed layer for producing a uniformed deposit.
Q. Who was present at the presentation?
A. I don't recall having made this presentation, so I don't recall who was present.
Q. Do you know if the presentation was made to anyone outside of Semitool?
A. I do not know.
Q. Under "Modified Electroplating," there is a reference to "Strike Bath."
A. Yes.

Page 138

MR. BROWN: Foundation.
BY MR. RIEDINGER:
Q. Experiment No. 6 that's referred to, for example, in Exhibit 53?
A. This experiment is clearly not the same as was specified in the design of Experiment No. 6.
Q. Is it -- does Exhibit 1000 describe the results of an eventual evolution or variation on Experiment No. 6?
A. My recollection is that Experiment No. 6 was deemed by Intel as being excessively large with too many wafers, and consequently, they asked, if I recall correctly, for a demonstration of feasibility before committing a large number of wafers for the plan that I had proposed.
My recollection is that these five wafers represented a quick feasibility check prior to Intel's deciding to move forward with an electroless seed layer enhancement process.
Q. A quick feasibility check on the concept of Experiment 6; is that correct?
A. Yes, that's my recollection.

Page 139

MR. BROWN: Object as vague to the question.
THE WITNESS: I'm sorry. I'm not giving you enough time.
MR. BROWN: That's okay.
BY MR. RIEDINGER:
Q. Before we go to Exhibit 57, why don't we see if we can get a little bit more of your understanding of how the proposals for exhibit -- for Experiment 6 changed, if they did at all.
So, I'm handing you a copy of what was previously marked as Exhibit 1054 and a copy of what was previously marked in another deposition as Exhibit 1056.
Starting with Exhibit 1054, do you recognize it?
A. Yes, I do.
Q. Did you write Exhibit 1054?
A. Yes, I did.
Q. And does your signature appear on the first page?
A. Yes, it does.
Q. What is Exhibit 1054?
A. 1054 represents a modification of

Page 140

the originally proposed Experiment 6.
Q. Is that modification shown on page 2 of Exhibit 1054?
A. Yes.
Q. What was the modification?
A. The modification was to redesign the experiment to require only 15, rather than 45, wafers; their modifications in the nominal electroless copper thickness targets, I believe. And seed layer thicknesses, I would have to go back and take a look again -- whether or not the seed layer thicknesses that are expected here were changed, but I believe they were. Rather than 500 to 1500 angstroms, from 500 to 1000 angstroms.
Q. And then, I would like you to look at Exhibit 1056. Do you recognize Exhibit 1056?
A. Yes, I do.
Q. Did you write Exhibit 1056?
A. Yes, I did.
Q. And what is Exhibit 1056?
A. Exhibit 1056 is a compilation of different documents produced at different times.

Page 141

Q. Did you write all of them?
A. My recollection is that I authored all of these.
Q. Okay. Can you identify for me which groups of paper represent a single document, if any? I'm assuming that one or more pages in this represent a single document. I'm trying to identify the documents that make up Exhibit 1056.
A. Yes, I am too. The first page of 1056 is the same as the first page, to the best of my ability to tell, of 1054.
Q. Before you go on, I note that on the first page of 1056, there is the statement underneath the line that says, "Following text is copied from a fax originally transmitted on Friday, May 23, but not received."
A. Yes. So --
Q. Do you recall that event occurring?
A. I do not recall that event occurring.
Q. And then what other documents --
A. The second page that this says, "Pages Including Cover: 2" -- the second page

Page 134

cetera. Other individuals, I do not recall having sat across the table or face-to-face with them and discussed this.
BY MR. RIEDINGER:
Q. Okay. Thank you. Were experiments ultimately conducted that showed -- conducted at Semitool -- that showed that an electroless copper deposition process created conformal layers that improved the seed layer function?
A. My recollection is that the limited number of experiments that were conducted were deemed to be unsuccessful, in that we were either unable to deposit electroless copper on regions where the seed layer was already discontinuous or alternatively, it did not produce a conformal layer, in fact, produced a scenario where we deposited excessive material at the upper regions of the step as compared to the amount deposited in the lower regions of the step leading to unsuccessful bulk deposition.
MR. MELNIK: I'm sorry. Could I have the question read back to which Mr. Taylor gave the answer?

Page 135

THE REPORTER: Just the question?
MR. MELNIK: Yes.
(Record read.)
MR. RIEDINGER: And you provided an answer. Thank you.
BY MR. RIEDINGER:
Q. At your last deposition, you were asked regarding Exhibit 1000 -- I'm putting another copy of that in front of you. And I don't intend to go over the questions that you were asked about Exhibit 1000 before, but my question is, does Exhibit 1000 represent the results that you just described?
MR. BROWN: Vague. Compound.
THE WITNESS: This is an example of an experiment that produced results such as I have just described.
BY MR. RIEDINGER:
Q. And I believe your answer indicated that there are different ways that there was a lack of success. Which kinds of lack of success, if any, is shown by Exhibit 1000?
MR. BROWN: Vague as to "success."
MR. MELNIK: Join.
THE WITNESS: In this case, there

Page 136

were observations of both center slit-like voids, as well as, voids on the side walls of structures.
In the case of the former, center voids would have indicated a tendency of the electroless film to pinch off at the top of the structure or to be so preferentially deposited at the top of the structure as to give rise to subsequent pinch off in bulk deposition.
In the latter case where voids were observed on the side wall --
THE REPORTER: Would you slow down?
THE WITNESS: Yes.
THE REPORTER: In the case where voids --
THE WITNESS: -- were observed on the side wall, we would have concluded that the electroless process was unsuccessful in producing a continuous seed layer in those regions.
BY MR. RIEDINGER:
Q. If you look -- excuse me -- if you look at the second page of Exhibit 1000

Page 137

under the heading "Summary," the first sentence reads, "Electroless plating was used to enhance the seed layer of four experimental wafers with some success." Do you agree with that conclusion?
MR. BROWN: Vague.
MR. MELNIK: Join.
THE WITNESS: Actually, my technical assessment of this experiment was that it was unsuccessful in that we were attempting show the small structures could be improved, but this does suggest that the larger structures that were filled, in any event, were not pinhole structure resulting in the trench being shut off -- it appears as though this may have had some -- some measurable benefit on larger structures but not smaller ones.
BY MR. RIEDINGER:
Q. And which size structures are you characterizing as larger?
A. Larger trenches, in particular, larger than about 0.7 microns.
Q. Thank you. Does Exhibit 1000 describe the results of Experiment No. 6?

Page 146

improvements were going to be required on a number of attributes, the projection for what was going to be needed or what would actually be introduced over the period from 1996, '97 through 2001.
Q. Do you know when the Hardware Generation Roadmap on the last page of Exhibit 1056 was prepared?
A. I don't recall exactly when I did it.
Q. Do you know who it was provided to?
A. It was provided to Bob Berner, and I believe it was also provided to our marketing organization.
Q. Was it provided to anyone else within the Advanced Technology Group?
A. It was available to the other members of the Advanced Technology Group.
Q. You say, "available." How was it available?
A. It was -- there was no -- there was no segregation of this information. It was available either because it had been presented in front of them during one of

Page 147

these group meetings, or it was alternatively available at their request from the -- from either myself or from the departmental administrator.
Q. Okay. Let's go to Exhibit 57. It's this one.
A. Okay.
Q. Do you recognize Exhibit 57?
MR. MELNIK: I was pointing out to Counsel for Applied that the source of the bad seed layers seems to be Applied Materials.
MR. BROWN: I noted that it was within Roman's character to notice that.
THE WITNESS: These are -- these are familiar. I do not recall these specifically out of the many dozens of photographs that were exchanged with Intel.
BY MR. RIEDINGER:
Q. If you go back to Exhibit 53 -- yes, that one -- which referred to being shown experimental observations. Do the photographs that are Exhibit 57 correspond to the experimental observations that are discussed in Exhibit 53?

Page 148

A. I don't remember.
Q. We are just about finished. I'll probably take a break to clean up, but there are a couple of questions I do want to ask.
Do you currently live in Oregon?
A. I do.
Q. Where do you live?
A. I live in Portland downtown.
Q. Do you have any current plans to move out of Oregon?
A. I do not have any current plans to move out of Oregon.
Q. Which Applied Materials facility do you work in?
A. I work out of the facility in Hillsboro, E-Tech, which is an Applied Materials' subsidiary.
Q. Are you still attending school?
A. I am not, much to my chagrin.
Q. Do you intend to return to school at any point?
A. I intend to, but no specific plans. I haven't re-enrolled.
Q. I would like your current exact address, if you don't mind.

Page 149

A. 0308 Southwest Montgomery Street, No. 206, Portland, Oregon, 97201.
MR. RIEDINGER: And I've been told we need to change the tape. So, let's take a break right now.
(Off the record.)
BY MR. RIEDINGER:
Q. Just a couple more questions, Mr. Taylor. Are you aware of any documents that we haven't talked about today, but which you believe would help tell the story of the development of seed layer enhancement at Semitool?
A. No, I'm not aware of any documents that would aid this process or make any reference, in fact, to the development of seed layer enhancement at Semitool.
Q. Did you do anything to prepare for today's deposition?
A. I did nothing to prepare for today's deposition.
Q. You didn't meet with anyone?
A. And please excuse me. Yesterday afternoon, I met with Nicholas here in this office for a period of about two hours.

Page 142

of this exhibit doesn't appear to have a specific connection to the first page, nor do any of the following pages.
Q. Is page 2 the second page, production number --
A. Of 1056?
Q. Yeah -- 20770 --
A. Yes.
Q. -- second page of Exhibit 1056, is that page, by itself, a separate document?
MR. BROWN: Do you mean separate from the first page or you mean separate, standing alone and having no relation to any of the other pages?
BY MR. RIEDINGER:
Q. A separate document by itself, standing alone with respect to all of the other pages in Exhibit 1056.
A. I believe that's true.
Q. What is the second page of Exhibit 1056?
A. Second page of this exhibit is entitled "Recommended Experimental Strategies" and describes three types of experiments that are recommended to be pursued.

Page 143

Q. Do you know when that was written?
A. I do not.
Q. Do you know why you wrote it?
A. Because I wanted to recommend the three experimental strategies.
Q. Do you know who, if anyone, it was given to?
A. I do not remember.
Q. And then the next four pages, which are production pages 20771 through 775. Do they make up a separate document? I guess that's five pages.
A. Yes, they do make up a separate document, and they -- each page is associated with what's called a specific bath type, bath type 1, 2, 3, 4 and 5.
Q. Do they correspond to anything else that's described in Exhibit 1056?
A. There is a similarity to the experiment design to an experiment recommended on page 2, but there are differences between what was actually reported in this five pages and what was part of this recommendation.
Q. Do they -- do those five baths correspond to the baths that are identified

Page 144

in Exhibit 53 for Experiment 5?
A. I don't know.
Q. Let's move on to page 20776, which, I believe, is the eighth page of Exhibit 1056. What is that?
A. As I recall, these were experiments. This is a brief summary of the total number of wafers employed to conduct Experiments numbered 6 through 11 that were conducted with wafers provided by Intel.
Q. Sorry. This was a plan, or they were a description of what was actually done?
A. My recollection is that this is a description of what was actually done as a way of accounting to Intel for the total number of wafers that had been employed to that -- to that date.
Q. Okay. When was page eight, that's 20776, prepared?
A. I don't know. I don't remember.
Q. Does the first box on page 20776 describe the experiments that were reported in Exhibit 1000?
A. In Exhibit 1000, only five wafers are reported, and this box refers to an

Page 145

experiment with 15 wafers.
Q. Does page 20776 refer to a variation, then, of Experiment 6 that was considered at sometime?
A. That's my recollection.
Q. Do you know if the variation that's described on page 20776 was actually conducted?
A. I do not recall whether an experiment involving 15 wafers were conducted.
Q. Who, if anyone, was page 20776 provided to?
A. I believe that this -- my recollection is that this was provided to Intel as a way of accounting for the total number of wafers required to conduct either a proposed or completed experimentation.
Q. Do you know who at Intel?
A. I believe it was Chun Mu. He was my principal point of contact through this entire period of time.
Q. In the last page of Exhibit 1056, what is that?
A. This is a road map that was produced to highlight what technological

Page 154

A. One moment, please. "No Clean Before Electroless" -- ECD 1.5 pre-wet no -- this one had no pre-wet or pre-clean, which is what that's referring to. And since it does have the full thickness of ECD deposit, that would have to refer to wafer 335.
Q. Okay. And going back to the third SEM, do you see the feature that sort of has a white box around it on the right-hand side of the SEM?
A. Yeah. The white box has the dimensions listed on the upper -- upper, upper left-hand side.
Q. And is that feature about 0.7, 0.8 microns?
A. At least according to the way the boxes are set with this -- reported here by the SEM as 0.73.
THE REPORTER: By the?
THE WITNESS: S-E-M.
BY MR. MELNIK:
Q. As 0.7 microns?
A. 0.73 is what it says. That's the box dimension.
Q. And do you see -- and this feature

Page 155

shows a process where PVD seed layer was enhanced by an electroless step prior to electrolytic fill?
A. That's the intention here, right.
Q. And do you see any large center voids in the 0.7 micron feature of the type that we saw on SEM number five and number six?
A. No, these are different. The quality of the SEM is really pretty poor, but there is nothing like the center -- center void that was on five or six.
Q. So, does comparing SEM No. 3 with SEM No. 5 show that the electroless enhancement process improved the quality of the subsequent fill for the 0.7 micron feature?
A. That's -- that seems to be the case. I think that's the basis for the -- for the conclusion that Matt Johnson offered that there did appear to be some success on the larger structures.
Q. So, when you said that this experiment was unsuccessful, did you mean that it was unsuccessful for -- when I say, "this

Page 156

experiment," I mean the electroless enhancement experiment.
A. All right.
Q. -- that it was unsuccessful for the smaller structures but showed some improvement for the larger structures?
A. That's fair. I mean, the focus of my previous comment was on the small structures and the larger structures -- I won't argue with Matt's conclusion. Yes, it did seem to be successful for the larger ones, but not for the small ones.
MR. MELNIK: Thank you. I don't have any further questions.
MR. RIEDINGER: I have no further questions.
MR. BROWN: I have none.
MR. RIEDINGER: Thank you very much.
(Whereupon, the deposition concluded at 11:44 a.m.)

Page 157

DESCRIPTION OF EXHIBITS

Exhibit	Description
50	10-24-96 Memo
51	Organizational Chart
52	4-29-97 Memo
53	5-1-97 Fax
54	5-2-97 Agenda
55	4-2-97 Agenda
56	Production No. NOVONLY010008-14
57	Production No. 009884-901

Page 150

It's exactly correct. Please excuse me.
Q. Did you review any documents at the time?
A. At that time, we didn't exchange any documents. The only document that we made reference to was this transcript of the previous deposition.
Q. And the meeting was between you and Mr. Brown only?
A. Yes, that is correct.
MR. RIEDINGER: I have no further questions.
MR. MELNIK: Can we take a one-minute break, and then I have just a few questions.
MR. RIEDINGER: Sure.
(Off the record.)
EXAMINATION
BY-MR.MELNIK:
Q. Okay. Mr. Taylor, if I could ask you, please, to pull up -- pull up a copy of the Matt Johnson memo, Exhibit 1000.
A. Okay.
Q. And --
A. Got it here.

Page 151

Q. -- I'm also going to give you another copy of it that was one of the high quality copies that was produced during Dr. Stevens' deposition. It has a different Bates number, but it has higher quality SEMs.
A. All right.
Q. I would like this one back. It's just for the witness to refer to the high quality SEMs?
MR. RIEDINGER: Do you mind if I take a quick look?
MR. MELNIK: Sure. It's totally clean.
MR. RIEDINGER: Thank you.
BY MR. MELNIK:
Q. Okay. Mr. Taylor, could you please take a look for me at the fifth and sixth SEMs, the ones that are labeled "ECD only"?
A. I want to make sure I understand which page are we talking about? 3097?
Q. You know, I'm --
A. Fifth and sixth SEMs?
Q. Yeah. I am sorry. The Bates numbers on mine are different. They are the

Page 152

two that are labeled "ECD only" in the upper left-hand corner?
A. "ECD only," right.
Q. Okay. And do you have an understanding of what the term "ECD only" means?
A. In this particular case, this would have been in reference to the wafer I.D. 341 where it had no electroless deposition.
Q. So, this was a wafer that had PVD seed and then electroplating on top?
A. Yes. ECD only and the fact 341 is explicitly identified here on this -- this SEM.
Q. Both SEMs?
A. Yes, on both of them.
Q. And in reviewing the fifth and sixth SEM that refer to wafer 341, do you observe that -- well, on the fifth SEM, the one that's labeled 341-8 --
A. Yes.
Q. -- what is the feature size of the features that are shown there?
A. It appears to be at the top in the range of 0.7, 0.8 microns --

Page 153

Q. Okay?
A. -- based on the scaler shown at the bottom.
Q. And for the features that are shown on the fifth SEM, do you observe a center void or pinhole?
A. Yeah, of a large central void.
Q. Okay. Now, could I get you to take a look, please, at the third SEM? And in the upper right-hand corner on that page, it says "No Clean Before E-Less-3."
MR. BROWN: I think you meant left-hand corner.
MR. MELNIK: I'm sorry. Left-hand corner. Thank you.
THE WITNESS: Yes.
BY MR. MELNIK:
Q. And on Exhibit 1000, this would be Bates page ST003068, and on the one that you are looking at, the Bates page is different but --
A. Yes.
Q. Okay. And do you have an understanding that this SEM corresponds to wafer 335?

Videotaped Deposition of Thomas Taylor, Vol. II - October 23, 2002
*** * * HIGHLY CONFIDENTIAL * * ***

Page 162

Page No. Line No. Change to:

Reason for change:
Page No. Line No. Change to:

Reason for change:
Page No. Line No. Change to:

Reason for change:
Deposition of Thomas Taylor
.
Page No. Line No. Change to:

Reason for change:
Page No. Line No. Change to:

Reason for change:
Page No. Line No. Change to:

Reason for change:
Page No. Line No. Change to:

Reason for change:
Page No. Line No. Change to:

Page 163

Reason for change:

Page No. Line No. Change to:

Reason for change:

.

.

SIGNATURE:_____DATE:_____

Thomas Taylor.

Videotaped Deposition of Thomas Taylor, Vol. II - October 23, 2002
*** * * HIGHLY CONFIDENTIAL * * ***

STATE OF OREGON)
County of Multnomah) ss.

I, Carol Ann Nevarez a Certified Shorthand Reporter for the State of Oregon, do hereby certify that, pursuant to Oregon Rules of Civil Procedure, THOMAS TAYLOR personally appeared before me at the time and place mentioned in the caption herein; that the witness was by me first duly sworn on oath, and examined upon oral interrogatories propounded by counsel; that said examination, together with the testimony of said witness, was taken down by me in stenotype and thereafter reduced to typewriting; and, that the foregoing transcript constitutes a full, true and accurate record of said examination of and testimony by said witness, and of all other proceedings had during the taking of said deposition, and of the whole thereof.

Witness my hand at Portland, Oregon, this 28th day of October, 2002.

_____

Carol Ann Nevarez
Certified Shorthand Reporter
Certificate No. 94-0303.

CAPTION

The Deposition of Thomas Taylor, taken in the matter, on the date, and at the time and place set out on the title page hereof.

It was requested that the deposition be taken by the reporter and that same be reduced to typewritten form.

It was agreed by and between counsel and the parties that the Deponent will read and sign the transcript of said deposition.

CERTIFICATE

STATE OF :
COUNTY/CITY OF :

Before me, this day, personally appeared, Thomas Taylor, who, being duly sworn, states that the foregoing transcript of his/her Deposition, taken in the matter, on the date, and at the time and place set out on the title page hereof, constitutes a true and accurate transcript of said deposition.

Thomas Taylor

SUBSCRIBED and SWORN to before me this day of , 2002 in the jurisdiction aforesaid.

My Commission Expires Notary Public

DEPOSITION ERRATA SHEET

RE: Alexander Gallo & Associates
File No. 1899
Case Caption: Semitool, Inc. vs. Novellus Systems, Inc.
Deponent: Thomas Taylor
Deposition Date: October 23, 2002

To the Reporter:
I have read the entire transcript of my Deposition taken in the captioned matter or the same has been read to me. I request that the following changes be entered upon the record for the reasons indicated. I have signed my name to the Errata Sheet and the appropriate Certificate and authorize you to attach both to the original transcript.

Page No. Line No. Change to:

Reason for change:
Page No. Line No. Change to:

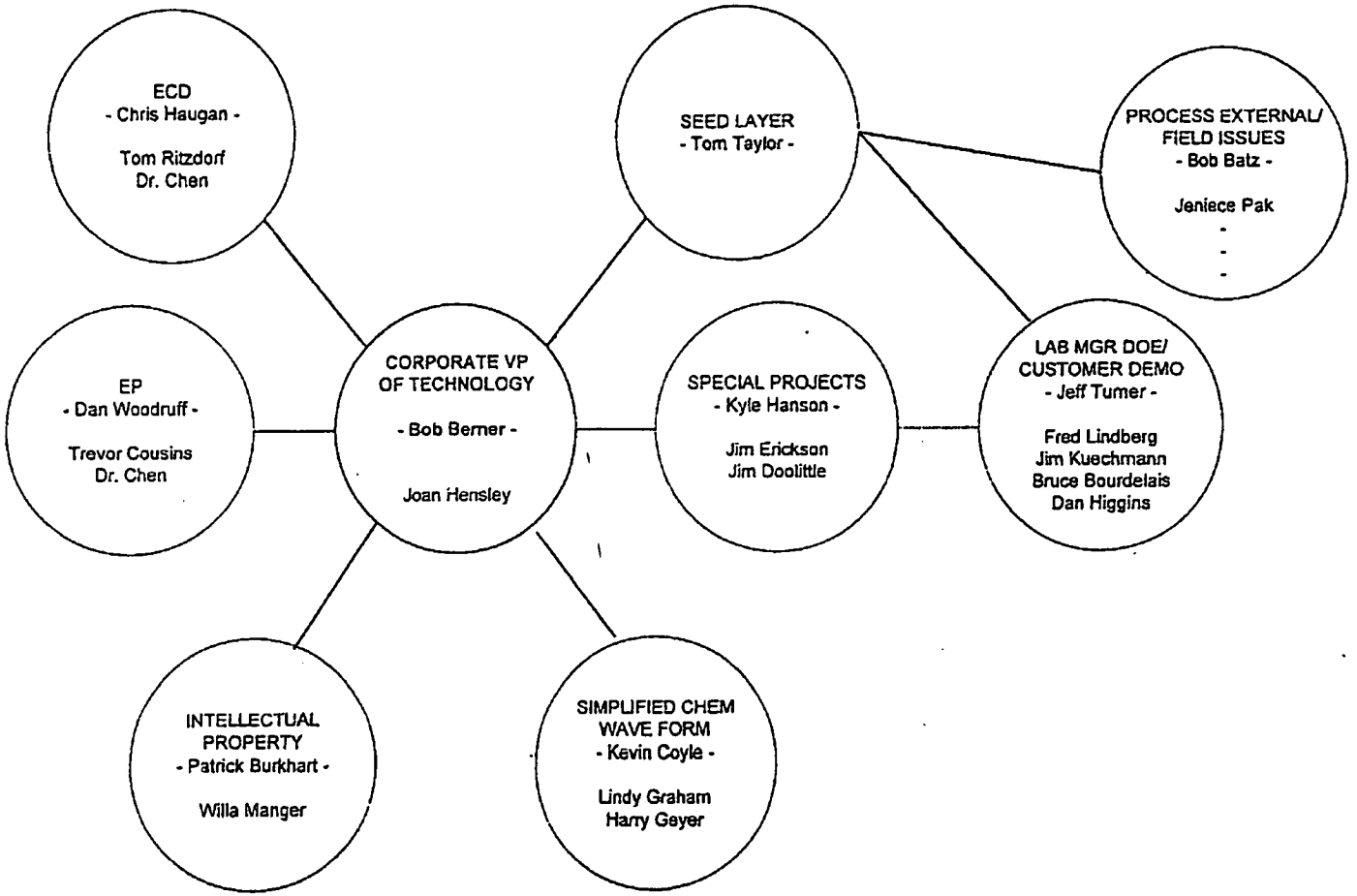
Reason for change:

Exhibit F

CONFIDENTIAL INFORMATION

SEMITOOL

Advanced Technology Group



Bob Berner

April 9, 1997

009915

Ex. 51

SEMITOOL®

Advanced Technology Group

Process:

- Simple Chemistry
- Waveforms
- Analysis
- Chem. Analysis Replenishment

Film Quality Vs. Reactor Geometry:

- Modeling
- Experiments

Automation:

- Reactor Design

SEMITOOL®

Advanced Technology Group

- Process
- Film Quality Vs. Reactor
- Automation

Exhibit G

SEMITOOL®

Advanced Technology Group

655 West Reserve Drive, PO Box 7010, Kalispell, MT 59904 Phone: 406-752-2107 Fax: 406-752-5522

To: Bob Bemer, Chris Haugan, Dan Woodruff, Kevin Coyle, Tom Taylor, Kyle Hanson, Jeff Turner, Bob Batz, Patrick Burkhart

From: Joan Hensley

Date: 2-Apr-97

Subject: Meeting Agenda, April 4, '97

cc: ATG Group, Ray Thompson, Greg Perkins, John Sullivan

Agenda

Meeting: ATG Meeting
Executive Lunch Room East & West
Friday, April 4, 1997
8:30 am

Presentations: Team leaders will each have approximately 20 min. for their presentation. The presentation will include their project description, tentative schedule, and the expected results to include the definition of the completion of the project/Criteria.

	Presenter	Project
8:30 - 8:50 am:	Chris Haugan	Modeling
8:50 - 9:10 am:	Dan Woodruff	Polish
9:10 - 9:30 am:	Kevin Coyle	Wave Form/Simplified Chem
9:30 - 9:50 am:	Tom Taylor	Seed Layer Development
9:50 - 10:10 am:	Kyle Hanson	Special Projects
10:10 - 10:20 am:	Bob Batz	Solder
10:20 - 10:40 am:	Patrick Burkhart	Intellectual Property

Exhibit H

Tom Taylor

Ex. 56

Barrier Layer Optimization

- Materials
  - Ti/TiN, Ta, TaN, WN, …
- Deposition Method
  - PVD vs. CVD
- Selection Criteria
  - Cu Diffusivity at Elevated Temperatures
  - Adhesion to Dielectrics
  - Adhesion to ECD Seed Layer
  - Resistivity
  - Galvanic Reactivity With Cu
  - Morphology / Crystallinity

Seed Layer Optimization

- Deposition Method
  - PVD vs. CVD
- Major Issues
  - Step Coverage
  - Thickness Requirements
    - Continuity in high aspect-ratio features
    - "Pinch-off" in throats of trench/via patterns
    - Scaling for current density effects vs. substrate diameter
    - Throughput balancing
  - Nucleation Site Density
    - Influence on ECD Cu morphology / grain size distribution

PVD vs. CVD for Barrier/Seed

- PVD Methods
  - "Conventional", collimated-beam, metal ion sputter
  - High temperature process for step coverage?
- CVD Methods
  - Thermal CVD vs. Plasma-Enhanced CVD (PECVD)
  - Precursor cost and efficiency
  - Better step coverage than PVD
  - Environmental concerns -- exhaust scrubbers
  - System cleaning requirements
- Combination Methods -- AMAT?

Seed Layer Enhancement

- Electroless Cu on Thin PVD/CVD Cu Seed
  - No Applied Current Eliminates "Deplating" Danger
  - Less Sensitive to Initial Seed Layer Discontinuities
  - Initial Seed Layer Requirements 200 - 500 A
  - Flexibility to Modify Pre-ECD Seed for Variations in Device Type, Substrate Size, ...
- Modified Electroplating
  - "Strike Bath" Concept
  - Electrolyte/Plating Conditions Optimized for Early Film Growth

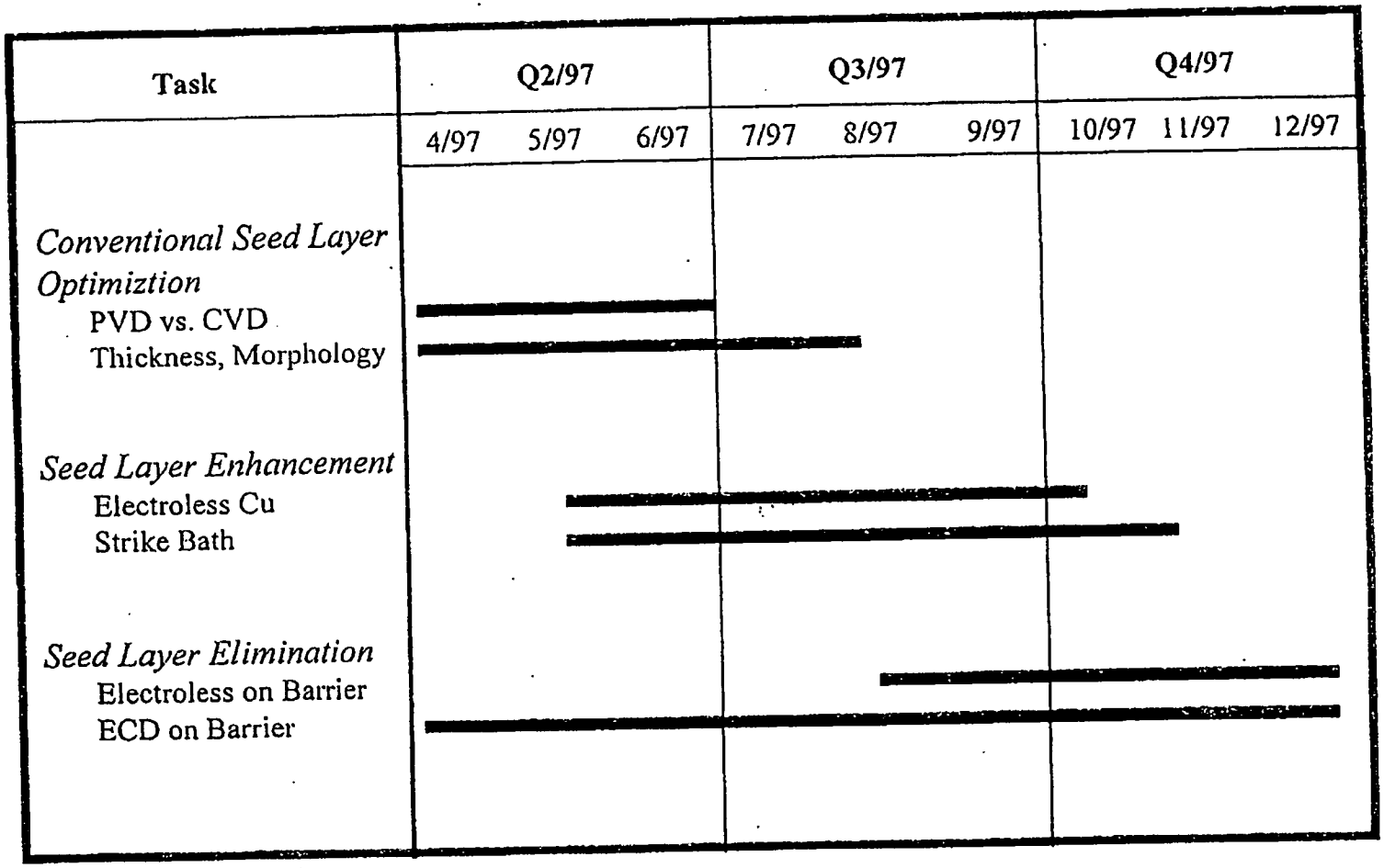
TAYLOR 4-4-97

Seed Layer Elimination

- Electroless Cu Dep on Catalyzed Barrier
  - Catalysts Include : Cu (naturally), Au, Pd, Pt, ?
  - Literature Includes Data on Catalytization of TiN by Immersion in PdCl or PtCl Baths
- Direct-to-Barrier ECD Plating
  - Identify Materials Which Are "Dual Function" -- Good Cu Diffusion Barrier and Platable with Good Uniformity and Adhesion
  - First Attempts w/ Ir and IrO2
  - Modified TiN ?

Taylor 4-4-97

Project Schedule



TAYLOR 4.4.97

Exhibit I

SEMITOOL®

Metallization Process Group

655 West Reserve Drive, PO Box 7010, Kalispell, MT 59904 Phone: 406-752-2107 Fax: 406-752-5522

FAX COVER SHEET

To:	**Chun Mu**	**Fax#**	**408-765-2949**
From:	**Thomas Taylor**		
Date:	**May 1, 1997**		
Subject:	**Experiment 5 & 6 Proposals**	**Pages Including Cover:**	**4**

Dear Chun,

Thanks for hosting yet another fascinating meeting. You must know how much I love being shown experimental observations that I can't explain, since you manage to surprise me every time we get together.

I appreciate being given copies of the colorized SEM pastiches showing the evolution of the Cu deposition in a range of trench widths, and the unmanipulated photos from which the composites were produced. I have had a chance to review these with a number of he process engineers here in Kalispell, and we've tended to consensus on the probable mechanism for the different film growth behavior demonstrated by the various power supply settings (DC, FWD, PR). In general, we agree that the likely hypothesis is an interaction between the plating waveform (or peak current density) and the adsorption of the organic additives present in the electrolyte, particularly the leveller/suppressant agents.

As agreed, I have roughly defined experiments intended to increase our mutual knowledge of the mechanisms at work. As before, Semitool will supply the electroplating process, Intel will supply the wafers, and I will personally supply the dumbfounded looks when the results are presented.

The first experiment is directly related to the results discussed on Monday, April 28th, and should be self-explanatory. The second experiment is related to my proposal to supplement the step-coverage of PVD seed layers by a short electroless Cu deposition process prior to beginning electrolytic plating; if you are at all interested, we may choose to pursue this either immediately or at some later date.

Please call if you have any questions or suggestions on how the proposed experiments can be improved.

Very Best Regards,

T. Taylor

Experiment 5 (in our ongoing series)
Evaluate interactions between the plating waveforms and peak current densities with the brightener and leveller/suppressant agents in the electrolyte.

Barrier : Ta or TaN, thickness = 150A

Seed layer : PVD Cu, thickness = 1500A

Experiment conducted as full factorial, with 5 electrolyte solutions and 9 plating power conditions. Five replicate wafers to be run (FWD pulse plating at standard current density, one at each bath composition). Total wafers required = [(9*5) + 5] = 50 wafers.

Bath Chemistries To Be Evaluated :

1) "STI Basic Bath" (CuSO4/H2SO4/H2O)
2) Enthone-OMI CU BATH M with no additives
3) Enthone-OME CU BATH M with brightener/carrier agents only at nominal working strength
4) Enthone-OME CU BATH M with leveller/suppressant agents only at nominal working strength
5) Enthone-OME CU BATH M with both additive packages at nominal working strength as control

Plating Power Supply Setpoints To Be Evaluated :

For all conditions, peak cathodic current densities of 23mA/cm2, 30.5mA/cm2, and 38mA/cm2
For all conditions, total plated thickness of 4000 A (approx. 6.4 Amp min)
Conditions : DC plating, FWD pulse, Pulse Reverse

Please see the attached spreadsheet labelled EXPERIMENT 5 for the run-by-run schedule.

Experiment 6
Determine if marginal PVDseed layer step coverage can be improved by supplementary electroless deposition.

Barrier: Ta or TaN, 150A thickness

Seed layer : PVD Cu; thickness splits : 500A, 1000A, 1500A

Number of wafers per seed layer thickness : 15 (to allow for some trial-and-error process development in the following electroless deposition process)

Electroless deposition process targets : Add 500A, 1000A, 1500A of Cu (up to 5 wafers each per seed thickness)

Total number of wafers : 45

Following electroless deposition, one wafer per seed layer /electroless supplement thickness combination will be sectioned for SEM analysis. The remaining wafers will be processed through a baseline Cu electroplating recipe, consisting of Enthone-OMI CU BATH M with additives, and FWD pulse plating at nominal parameters. Wafers will be sectioned to determine gap fill characteristics and grain morphology. XRD should be performed to determine crystallinity and orientation.

Please see the attached spreadsheet labelled EXPERIMENT 6 for the run-by-run schedule.

DC AND PR
6,8 AND 9.0
5 BATHS

FWD
6.8 9.0
1 ↓
2 3 BATHS

EXPERIMENT 5

Bath Types :

1) "STI Basic Bath"
2) CU BATH M with no additives
3) CU BATH M with brightener/carrier only
4) CU MATH M with leveller/suppressor only
5) CU BATH M with all additives (brighteners and levellers)

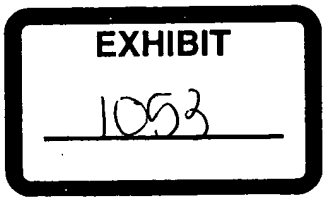
Wafer #	Bath Type	Applied Power	Peak Current
1	1	DC	6.8A
2	1	DC	9.0A
3	1	DC	11.2A
4	1	FWD	6.8A
5	1	FWD	9.0A
6	1	FWD	11.2A
7	1	PR	6.8A
8	1	PR	9.0A
9	1	PR	11.2A
10	2	DC	6.8A
11	2	DC	9.0A
12	2	DC	11.2A
13	2	FWD	6.8A
14	2	FWD	9.0A
15	2	FWD	11.2A
16	2	PR	6.8A
17	2	PR	9.0A
18	2	PR	11.2A
19	3	DC	6.8A
20	3	DC	9.0A
21	3	DC	11.2A
22	3	FWD	6.8A
23	3	FWD	9.0A
24	3	FWD	11.2A
25	3	PR	6.8A
26	3	PR	9.0A
27	3	PR	11.2A
28	4	DC	6.8A
29	4	DC	9.0A
30	4	DC	11.2A
31	4	FWD	6.8A
32	4	FWD	9.0A
33	4	FWD	11.2A
34	4	PR	6.8A
35	4	PR	9.0A
36	4	PR	11.2A
37	4	DC	6.8A
38	4	DC	9.0A
39	4	DC	11.2A
40	5	FWD	6.8A
41	5	FWD	9.0A
42	5	FWD	11.2A
43	5	PR	6.8A
44	5	PR	9.0A
45	5	PR	11.2A
46	1	FWD	6.8A
47	2	FWD	6.8A
48	3	FWD	6.8A
49	4	FWD	6.8A
50	5	FWD	6.8A

Experiment 6

Wafer #	Seed Layer Thickness	Electroless Cu Thickness	Post-processing
1	500 A	500 A	SEM Section
2	500 A	500 A	Electroplate (1.0m) and SEM Section
3	500 A	500 A	Electroplate (1.0m) and SEM Section
4	500 A	500 A	Electroplate (1.0m) and SEM Section
5	500 A	500 A	Electroplate (1.0m) and SEM Section
6	500 A	1000 A	SEM Section
7	500 A	1000 A	Electroplate (1.0m) and SEM Section
8	500 A	1000 A	Electroplate (1.0m) and SEM Section
9	500 A	1000 A	Electroplate (1.0m) and SEM Section
10	500 A	1000 A	Electroplate (1.0m) and SEM Section
11	500 A	1500 A	SEM Section
12	500 A	1500 A	Electroplate (1.0m) and SEM Section
13	500 A	1500 A	Electroplate (1.0m) and SEM Section
14	500 A	1500 A	Electroplate (1.0m) and SEM Section
15	500 A	1500 A	Electroplate (1.0m) and SEM Section
16	1000 A	500 A	SEM Section
17	1000 A	500 A	Electroplate (1.0m) and SEM Section
18	1000 A	500 A	Electroplate (1.0m) and SEM Section
19	1000 A	500 A	Electroplate (1.0m) and SEM Section
20	1000 A	500 A	Electroplate (1.0m) and SEM Section
21	1000 A	1000 A	SEM Section
22	1000 A	1000 A	Electroplate (1.0m) and SEM Section
23	1000 A	1000 A	Electroplate (1.0m) and SEM Section
24	1000 A	1000 A	Electroplate (1.0m) and SEM Section
25	1000 A	1000 A	Electroplate (1.0m) and SEM Section
26	1000 A	1500 A	SEM Section
27	1000 A	1500 A	Electroplate (1.0m) and SEM Section
28	1000 A	1500 A	Electroplate (1.0m) and SEM Section
29	1000 A	1500 A	Electroplate (1.0m) and SEM Section
30	1000 A	1500 A	Electroplate (1.0m) and SEM Section
31	1500 A	500 A	SEM Section
32	1500 A	500 A	Electroplate (1.0m) and SEM Section
33	1500 A	500 A	Electroplate (1.0m) and SEM Section
34	1500 A	500 A	Electroplate (1.0m) and SEM Section
35	1500 A	500 A	Electroplate (1.0m) and SEM Section
36	1500 A	1000 A	SEM Section
37	1500 A	1000 A	Electroplate (1.0m) and SEM Section
38	1500 A	1000 A	Electroplate (1.0m) and SEM Section
39	1500 A	1000 A	Electroplate (1.0m) and SEM Section
40	1500 A	1000 A	Electroplate (1.0m) and SEM Section
41	1500 A	1500 A	SEM Section
42	1500 A	1500 A	Electroplate (1.0m) and SEM Section
43	1500 A	1500 A	Electroplate (1.0m) and SEM Section
44	1500 A	1500 A	Electroplate (1.0m) and SEM Section
45	1500 A	1500 A	Electroplate (1.0m) and SEM Section

Exhibit J

Tom Taylor



Experiment 6

Determine if marginal PVDseed layer step coverage can be improved by supplementary electroless deposition.

Barrier: Ta or TaN, 150A thickness

Seed layer : PVD Cu; thickness splits : 500A, 1000A, 1500A

Number of wafers per seed layer thickness : 15 (to allow for some trial-and-error process development in the following electroless deposition process)

Electroless deposition process targets : Add 500A, 1000A, 1500A of Cu (up to 5 wafers each per seed thickness)

Total number of wafers : 45

Following electroless deposition, one wafer per seed layer /electroless supplen thickness combination will be sectioned for SEM analysis. The remaining waf will be processed through a baseline Cu electroplating recipe, consisting of Enthone-OMI CU BATH M with additives, and FWD pulse plating at nominal parameters. Wafers will be sectioned to determine gap fill characteristics and ..... morphology. XRD should be performed to determine crystallinity and orientation.

TAYLOR

PVD (INTEL
CVD (LETI

Experiment to Evaluate Electroless Cu Supplement of CVD Seed Layer

Evaluate Gap Fill, Grain Morphology

Wafer #	Seed Layer Thickness	Electroless Cu Thickness	Post-processing
1	500 A	500 A	SEM Section / Semitool
2	500 A	500 A	Electroplate (1.5m) and SEM Section / Semitool
3	500 A	500 A	Electroplate (1.0m) and SEM Section /INTEL
4	500 A	500 A	Electroplate (1.5m) and Evalute Grain Morphology / INTEL
5	500 A	500 A	Electroplate (1.5m) and Damascene CMP / INTEL
6	500 A	1000 A	SEM Section / Semitool
7	500 A	1000 A	Electroplate (1.5m) and SEM Section / Semitool
8	500 A	1000 A	Electroplate (1.0m) and SEM Section /INTEL
9	500 A	1000 A	Electroplate (1.5m) and Evalute Grain Morphology / INTEL
10	500 A	1000 A	Electroplate (1.5m) and Damascene CMP / INTEL
11	500 A	1500 A	SEM Section / Semitool
12	500 A	1500 A	Electroplate (1.5m) and SEM Section / Semitool
13	500 A	1500 A	Electroplate (1.0m) and SEM Section /INTEL
14	500 A	1500 A	Electroplate (1.5m) and Evalute Grain Morphology / INTEL
15	500 A	1500 A	Electroplate (1.5m) and Damascene CMP / INTEL
16	1000 A	500 A	SEM Section / Semitool
17	1000 A	500 A	Electroplate (1.5m) and SEM Section / Semitool
18	1000 A	500 A	Electroplate (1.0m) and SEM Section /INTEL
19	1000 A	500 A	Electroplate (1.5m) and Evalute Grain Morphology / INTEL
20	1000 A	500 A	Electroplate (1.5m) and Damascene CMP / INTEL
21	1000 A	1000 A	SEM Section / Semitool
22	1000 A	1000 A	Electroplate (1.5m) and SEM Section / Semitool
23	1000 A	1000 A	Electroplate (1.0m) and SEM Section /INTEL
24	1000 A	1000 A	Electroplate (1.5m) and Evalute Grain Morphology / INTEL
25	1000 A	1000 A	Electroplate (1.5m) and Damascene CMP / INTEL
26	1000 A	1500 A	SEM Section / Semitool
27	1000 A	1500 A	Electroplate (1.5m) and SEM Section / Semitool
28	1000 A	1500 A	Electroplate (1.0m) and SEM Section /INTEL
29	1000 A	1500 A	Electroplate (1.5m) and Evalute Grain Morphology / INTEL
30	1000 A	1500 A	Electroplate (1.5m) and Damascene CMP / INTEL
31	1500 A	500 A	SEM Section / Semitool
32	1500 A	500 A	Electroplate (1.5m) and SEM Section / Semitool
33	1500 A	500 A	Electroplate (1.0m) and SEM Section /INTEL
34	1500 A	500 A	Electroplate (1.5m) and Evalute Grain Morphology / INTEL
35	1500 A	500 A	Electroplate (1.5m) and Damascene CMP / INTEL
36	1500 A	1000 A	SEM Section / Semitool
37	1500 A	1000 A	Electroplate (1.5m) and SEM Section / Semitool
38	1500 A	1000 A	Electroplate (1.0m) and SEM Section /INTEL
39	1500 A	1000 A	Electroplate (1.5m) and Evalute Grain Morphology / INTEL
40	1500 A	1000 A	Electroplate (1.5m) and Damascene CMP / INTEL
41	1500 A	1500 A	SEM Section / Semitool
42	1500 A	1500 A	Electroplate (1.5m) and SEM Section / Semitool
43	1500 A	1500 A	Electroplate (1.0m) and SEM Section /INTEL
44	1500 A	1500 A	Electroplate (1.5m) and Evalute Grain Morphology / INTEL
45	1500 A	1500 A	Electroplate (1.5m) and Damascene CMP / INTEL

Barrier / Seed Layer Development

Experiments in Progress or Planning

Intel

Experiment to supplement PVD Cu seed with electroless Cu

Experiment to evaluate Ti, TiN, W, Ni, Al as platable seed/barrier layers

LETI

Experiment to suplement CVD Cu seed with electroless Cu

NCSU

Experiment to evaluate alternate PVD Cu seed deposition method

Independent

Experiment to determine if electroless Cu can be deposited reliably on activated TiN surface
Source of wafers : Sematech CMP Project

Experiment to evaluate Ir as platable barrier

Exhibit K

Advanced Technology Group

Meeting

9 am

Fri., May 2, 1997

Executive Lunch Rooms -East/West

Agenda

	Presenter	Project
9:00 - 9:10	Jeff Turner	Lab Scheduling and Resources
9:10 - 9:20	Tom Ritzdorf	Physical Parameter DOE -Experimental Design -Status and Plans
9:20 - 9:30	Kevin Coyle	Simplified Cu Electrolyte DOE -Experimental Design -Status and Plans
9:30 - 9:40	Tom Taylor	Seed/Barrier Layer Develop. -Experimental Design -Status and Plans Intel Mtg Update/Results
9:40 - 9:50	Lindy Graham	Investigation of Additive/Waveform Interactions in P.O.R. -INTEL Experimental Design
9:50 - 10:00	Bob Batz	Field ECD Process Support Plans

Exhibit L

SEMITOOL®

Metallization Process Group
655 West Reserve Drive, PO Box 7010, Kalispell, MT 59904 Phone: 406-752-2107 Fax: 406-752-5522

FAX COVER SHEET

To:	Dr. Shu Jin / Intel	Fax# (408) 765-2949	
From:	Tom Taylor	Phone#: 406-752-2107 Fax#: 406-755-3226	
Date:	May 23, 1997		
Subject:	Experiment 6 / Rev 2	Pages Including Cover: 2	

Hello, Shu.

Hopefully we'll get a chance to talk about the structure of Experiment 7 (as I'm calling the work described in your fax of May 20) rather than just exchange voice mail messages.

For your consideration, I've revised the structure of Experiment 6, per the discussions of last week, which included yourself, myself, and Dr. Ruth Brain. Please note that I've reduced the total wafer requirement to 15 wafers, as we had tentatively agreed. The structure of the experiment is 'analyzable' with a standard statistics package. I'd like to have all fifteen wafers available at the outset of the work, but will understand if you prefer to send only wafers # 11 - 14 initially to provide a few set-up runs and gauge feasibility. Even if you send all wafers together, my intention is to run only these few wafers first; if initial results are completely lacking in promise, I would stop before consuming the remainder to no purpose.

Thanks. If for any reason we miss speaking to each other this afternoon, I hope you have a great Memorial Day holiday.

Best Regards,

Tom T.

Tom Taylor

EXHIBIT
1054

Page 1 of 2

Experiment 6

Rev. 2

5/23/97

Wafer #	Seed Layer Thickness	Electroless Cu Thickness		Post-processing
1	500	500		SEM section after Electroless
2	"	"		Electroplate 1.0 micron Cu; SEM section
3	500	1000		SEM section after Electroless
4	"	"		Electroplate 1.0 micron Cu; SEM section
5	1000	500		SEM section after Electroless
6	"	"		Electroplate 1.0 micron Cu; SEM section
7	1000	1000		SEM section after Electroless
8	"	"		Electroplate 1.0 micron Cu; SEM section
9	750	500		Electroplate 1.0 micron Cu; SEM section
10	"	"		
11	750	750		SEM section after Electroless
12-14	"	"	x3	Electroplate 1.0 micron Cu; SEM section
15	750	1000		Electroplate 1.0 micron Cu; SEM section

Exhibit M

SEMITOOL®

Metallization Process Group
655 West Reserve Drive, PO Box 7010, Kalispell, MT 59904 Phone: 406-752-2107 Fax: 406-752-5522

FAX COVER SHEET

To:	**Dr. Shu Jin / Intel**	**Fax# (408) 765-2949**	
From:	**Tom Taylor**	**Phone#: 406-752-2107** **Fax#: 406-755-3226**	
Date:	**May 27, 1997**		
Subject:	**Experiment 6 / Rev 2**	**Pages Including Cover: 2**	

[Following text is copied from a fax originally transmitted on Friday, May 23, but not received]

Hello, Shu.

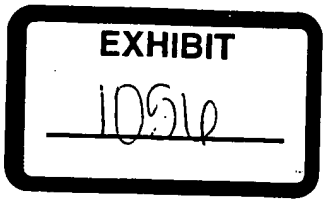
Hopefully we'll get a chance to talk about the structure of Experiment 7 (as I'm calling the work described in your fax of May 20) rather than just exchange voice mail messages.

For your consideration, I've revised the structure of Experiment 6, per the discussions of last week, which included yourself, myself, and Dr. Ruth Brain. Please note that I've reduced the total wafer requirement to 15 wafers, as we had tentatively agreed. The structure of the experiment is 'analyzable' with a standard statistics package. I'd like to have all fifteen wafers available at the outset of the work, but will understand if you prefer to send only wafers # 11 - 14 initially to provide a few set-up runs and gauge feasibility. Even if you send all wafers together, my intention is to run only these few wafers first; if initial results are completely lacking in promise, I would stop before consuming the remainder to no purpose.

Thanks. If for any reason we miss speaking to each other this afternoon, I hope you have a great Memorial Day holiday.

Best Regards,

Tom Taylor



Recommended experimental strategies

1) Follow-up on incremental deposition work. Should include pre-plating SE section of seed layer thickness. Recommend 1500A Cu on Ta or TaN barrier.
(20 wafers)

Concentration on FWD pulse plating
Deposition thicknesses of :

1000 A DC, FWD, PR
1500 A FWD
2000 A DC, FWD, PR
2500 A FWD
3000 A DC, FWD, PR
3500 A FWD
4000 A DC, FWD, PR
6000 A FWD
8000 A DC, FWD, PR

2) Experiment to explore the interaction between pulse plating parameters and electrolyte chemistry.
(50 wafers)

Bath 1 : Standard CU-BATH M with brighteners and levellers/suppressors

Bath 2 : CU-BATH M with brightening agents only (two concentrations, 50% & 100%)

Bath 3 : CU-BATH M with suppressors only (two concentrations, 50% & 100%))

Bath 4 : CuSO4/H2SO4 "Semitool Basic Bath"

Waveforms to include :

DC plating at two different current densities

FWD plating at two different conditions (modify pulse width/amplitude) and two time averaged current densities – preferrably the same as employed for DC. One condition should be equivalent to the conditions previously used for Intel samples.

Pulse-reversed waveforms. Based on results obtained in STI DOE.

3) Experiment to determine if seed layer continuity on feature sidewalls can be supplemented with electroless Cu.

Barrier Material : Ta or TaN, 150A thickness

Seed layer thicknesses : 500A, 1000A, 1500A

Number of wafers per seed layer thickness : 15

Total number of wafers : 45

Electroless deposition process targets : Add 500A, 1000A, 1500A of Cu (5 wafers each per seed thickness)

Bath Type	Pwr Type	Current	Trench Width	Observations			
1	DC	6.2	0.5	High central void	Smooth surface	Conformal	
			0.6	Central seam	Smooth surface	"	
			0.7	"	Closed at throat	"	
			0.75	"	"	"	
			0.8	"	"	"	
			0.85	"	Open at throat	"	
			0.9	"	"	"	
			0.95	"	"	"	
			1	"	"	"	
	DC	9	0.55	Central seam and gross bottom void		Smooth surface	
			0.65	Central seal and minor botom void		"	
			0.7	Central seam	Closed at throat		
			0.75	"	"		
			0.8	High central seam	"		
			0.85	Central seam	Open at throat	Conformal	
			0.9	"	"	"	
			0.95	"	"	"	
			1	"	"	"	
	PR	6.2	0.55	Central "pearl-string" voids	Smooth surface	Some sidewall voids	
			0.65	"	"	"	
			0.7	Central seam	Open at throat		
			0.75	"	"		
			0.8	Large cenral seam	"	Less conformal than DC	
			0.85	"	"	"	
			0.9	"	"	"	
			0.95	"	"	"	
			1				
	PR	9	0.55	Central "pearl-string" voids	Smooth surface	Sidewall voids	
			0.65	Central seam/voids	Closed at throat		
			0.7	"	"		
			0.75	"	Just open at throat		
			0.8	"	"		
			0.85	Wider central seam	Larger opening at throat	More conformal than 6.2A PR, less than DC	
			0.9	"	"		
			0.95	"	"		
			1	"	"		
	FWD	6.2	0.55	Central "pearl-string voids	Smooth surface	Sidewall voids	
			0.65	"	"	"	
			0.7	"	"		
			0.75	"	"		
			0.8	"	"		
			0.85	Small central seam	Throat closed, but creased		
			0.9	High central seam	Just open at throat		
			0.95	"	"		
			1	Appearance very similar to DC			
	FWD	9	0.55				
			0.65				
			0.7				
			0.75				
			0.8				
			0.85				
			0.9				
			0.95				
			1				

Bath Type	Pwr Type	Current	Trench Width	Observations			
2	DC	6.2	0.5	Central void	Few sidewall voids	Smooth surface	
			0.6	Central void/seams		"	
			0.7	Central seam	Closed at throat		
			0.75	"	"		
			0.8	"	"		
			0.85	"	"		
			0.9	Central seam	Just open at throat		
			0.95	"	"		
			1	"	"		
	DC	9	0.55	Gross sidewall/bottom voids		Smooth surface	
			0.65	Central seam and minor sidewall/bottom void			
			0.7	Central seam	Closed at throat		
			0.75	"	"		
			0.8	Central "pearl-string" v			
			0.85	Central seam	Open at throat	Conformal	
			0.9	"	"	"	
			0.95	"	"	"	
			1	"	"	"	
	PR	6.2	0.55	Central "pearl-string" voids	Smooth surface	Gross sidewall/bottom voids	
			0.65	"	"	"	
			0.7	Central seam	Open at throat		
			0.75	"	"		
			0.8	Large cenral seam	"	Less conformal than DC	
			0.85	"	"	"	
			0.9	"	"	"	
			0.95	"	"	"	
			1				
	PR	9	0.55	Central seam/voids	Smooth surface	Gross bottom/sidewall voids	
			0.65	"	Closed at throat	"	
			0.7	"	"		
			0.75	"	Just open at throat		
			0.8	"	Larger opening at throat		
			0.85	Wider central seam	"	Same as 6.2A PR	
			0.9	"	"		
			0.95	"	"		
			1	"	"		
	FWD	6.2	0.55	Slight central voids	Smooth surface	Sidewall/bottom voids	
			0.65	Central seams	"	"	
			0.7	Central seams	"		
			0.75	"	"		
			0.8	"	"		
			0.85	Larger central seam	Just open at throat		
			0.9	"	Open at throat		
			0.95	"	"		
			1	Appearance very similar to DC			
	FWD	9	0.55				
			0.65				
			0.7				
			0.75				
			0.8				
			0.85				
			0.9				
			0.95				
			1				

Bath Type	Pwr Type	Current	Trench Width	Observations			
3	DC	6.2	0.55	Large central seam	Thick Cu on mesa	Large divvit at trench top	
			0.65	Central seam	"	"	
			0.7	Central seam	Open at throat	Nonconformal dep; thick on mesa	
			0.75	"	"	"	
			0.8	Seam terminates at half trench height		Nonconformal, with re-entrant	
			0.85	"		"	
			0.9	"		"	
			0.95	"		"	
			1	Seam terminates at one-third height		Re-entrant	
	DC	9	0.55	Large central seam		Large divvit	
			0.65	"		Divvit / "pinch-off"	
			0.7	Central seam	Open at throat	Nonconformal	
			0.75	Seam terminates at two-thirds height		Slight re-entrant	
			0.8	Seam terminates at half height		Slight re-entrant	
			0.85	Seam terminates at half height		Re-entrant	Low central void
			0.9	"		"	
			0.95	"		"	
			1	Seam terminates at one-third height		"	
	PR	6.2	0.55	Central seam	Rougher surface	Sidewall voids	
			0.65	"	"	Large surface divvit	
			0.7	"Pearl-string" voids	"	Closed at thoat	
			0.75	Central seam	"	Just open at throat	
			0.8	Large divvit	"	Open at throat; nonconformal	
			0.85	"	"	"	
			0.9	Seam terminates at two-thirds height		"	
			0.95	"	"	"	
			1	Seam terminates at half height	"		
	PR	9	0.55	Central "pearl-string"	Rougher surface	Sidewall voids	
			0.65	"	Closed at throat	Non-conformal(?),	
			0.7	Central seam	"	Large divvit	
			0.75	"	"	"	
			0.8	"	Larger opening at throat		
			0.85	Seam terminates at 3/4 height	"		
			0.9	"	"		
			0.95	Seam terminates at two-thirds height			
			1	"	"		
	FWD	6.2	0.55	Large central voids (low, triangular)		Large divvit / "pinch-off"	
			0.65	"		"	
			0.7	Large central seam	Open at throat	Non-conformal; thick on mesa	
			0.75	"	"	Re-entrant	
			0.8	"	"	Very re-entrant	
			0.85	"	"	"	
			0.9	"	Keyholed		
			0.95	"	"		
			1	"	"		
	FWD	9	0.55				
			0.65				
			0.7				
			0.75				
			0.8				
			0.85				
			0.9				
			0.95				
			1				

Bath Type	Pwr Type	Current	Trench Width	Observations			
4	DC	6.2	0.55	Large central seam	Dendrite	Gross bottom/sidewall voids	
			0.65	Central seam		Slight sidewall voids	
			0.7	"Pearl-string"		Thin on mesa; divit at throat	
			0.75	Central seam		"	
			0.8	"Pearl-string"	Dendrite at trench mouth		
			0.85	Central void cloud	"	"	
			0.9	"	Porous Cu in trench	Large divit; thin on mesa	
			0.95	"	"	"	
			1	Open at trench mouth; very non-conformal (thick at trench bottom)			Re-entrant
	DC	9	0.55	Central seam	Gross dendrites	Gross bottom/sidwall voids	
			0.65	"	"	Very thin on mesa	Dendrites centered on trenches
			0.7	"	"	Thin on mesa	"
			0.75	Central seam	"	"	"
			0.8	Central seam / porous Cu		Same as above	"
			0.85	Void clouds / porous Cu		"	"
			0.9	"		"	"
			0.95	"		"	"
			1	"		"	"
	PR	6.2	0.55	Central seam	Spiky dendrites	More conformal (?)	
			0.65	"	"	Just open at throat	
			0.7	"	"	Triangular opening at throat	
			0.75		"	"	
			0.8	Deep seam	"	Large traingular opening at throat	
			0.85	"	"	"	
			0.9	"	"	"	
			0.95	Deep seam	Spiky, globular dendrites		Thin Cu, but conformal
			1	"	"		"
	PR	9	0.55	Central seam	Small spiky dendrites		
			0.65	"	"		Closed at throat, but with divit
			0.7	Central seam	"		Large triangular divit at throat
			0.75	"	"		"
			0.8	Deep central seam	"		"
			0.85	"	Huge globular dendrites		"
			0.9	"	"		"
			0.95				
			1				
	FWD	6.2	0.55				
			0.65				
			0.7				
			0.75				
			0.8				
			0.85				
			0.9				
			0.95				
			1				
	FWD	9	0.55	"Pearl-string" voids	Rougher surface; dendrites(?)		Conformal; closed at throat
			0.65	"	Small spiky dendrites		"
			0.7	"	Rougher surface	Porous Cu	"
			0.75	"	"	"	"
			0.8	"	"	"	"
			0.85	"	"	"	"
			0.9	Central seam	"	"	Just closed at thoat
			0.95	"	"	"	"
			1	Deep central seam	"		Just open at throat

Bath Type	Pwr Type	Current	Trench Width	Observations		
5	DC	6.2	0.55	High central seam	Smooth surface	Slightly thicker on mesa
			0.65	Slight central seam	"	"
			0.7	Slight central seam	"	"
			0.75	No seam visible	"	"
			0.8	"	"	"
			0.85	"	"	"
			0.9	"	"	"
			0.95	"	"	"
			1	No seam; completely filled		
	DC	9	0.55	High central seam	Smooth surface	Slightly thicker on mesa
			0.65	Central seam	"	"
			0.7	Slight cenral seam	"	"
			0.75	No seam visible	"	"
			0.8	High central "voidlet"	"	"
			0.85	No seam visible	"	"
			0.9	Central "voidlet"	"	"
			0.95	"		"
			1	No seam; completely filled		
	PR	6.2	0.55	Central seam	Open at throat	Smooth surface; conformal dep
			0.65	"Pearl-strings"	Just closed at throat	"
			0.7	Central seam	Open at throat (half filled)	"
			0.75	Central seam	One-third filled	"
			0.8	"	"	"
			0.85	"	"	"
			0.9	"	One-fourth filled	"
			0.95	"	"	"
			1	"	"	"
	PR	9	0.55	Central seam	Open at throat	Smooth surface; conformal dep
			0.65	"Pearl-strings"	Just closed at throat	"
			0.7	"Voidlet"	Closed at throat	Divit at throat
			0.75	No voids visible	"	"
			0.8	No voids visible	3/4 Filled	Large divit
			0.85	"	2/3 Filled	"
			0.9	"	"	Slightly thinner on sidewalls
			0.95	"	1/2 filled	"
			1	"	1/3 filled	"
	FWD	6.2	0.55			
			0.65			
			0.7			
			0.75			
			0.8			
			0.85			
			0.9			
			0.95			
			1			
	FWD	9	0.55	High cenral seam	Smooth surface	Slightly thicker between mesas
			0.65	"	"	"
			0.7	No seam visible	"	"
			0.75	"	"	"
			0.8	"	"	"
			0.85	"	"	"
			0.9	"	"	"
			0.95	"	"	"
			1	"	"	"

Experiment #	Dates	# Wafers	Wfr Size	Purpose	Conclusions
6	Early June	15	200mm	Seed supplement with electroless Cu Seed thicknesses of 500Å, 750Å, 1000Å Electroless Cu thickness of 500Å - 1000Å Electrolytic dep of 1.0µm	Pending; first 'set-up' wafers arrived at STI 6/2/97
7	TBD	TBD	200mm	Evaluation of low-frequency pulse Form of in-situ electropolish Relies on dep-etch sequence	Pending
8	05/12/1997	12	150mm	Evaluation of FWD, DC, PR waveforms Blanket and patterned wafers, TiN Barrier Other purposes unknown to STI	Waiting results
9	05/16/1997	18	200mm	Investigation of CVD Cu seed (500Å - 1500Å) Pre-clean' splits prior to barrier/seed DC/FWD, PR waveforms	Waiting results
10	05/28/1997	10	200mm	DOE over the factors of Waveform (FWD, PR) Peak Current (4.5, 5.3, 6.2A) Bath temp (15, 20, 25 deg. C) Brightener Conc. (50, 100, 150%)	Waiting results
11	06/03/1997	9	200mm	Evaluation of DC, FWD, PR TiN Barrier	Pending

Total Wafers to Date : **165**

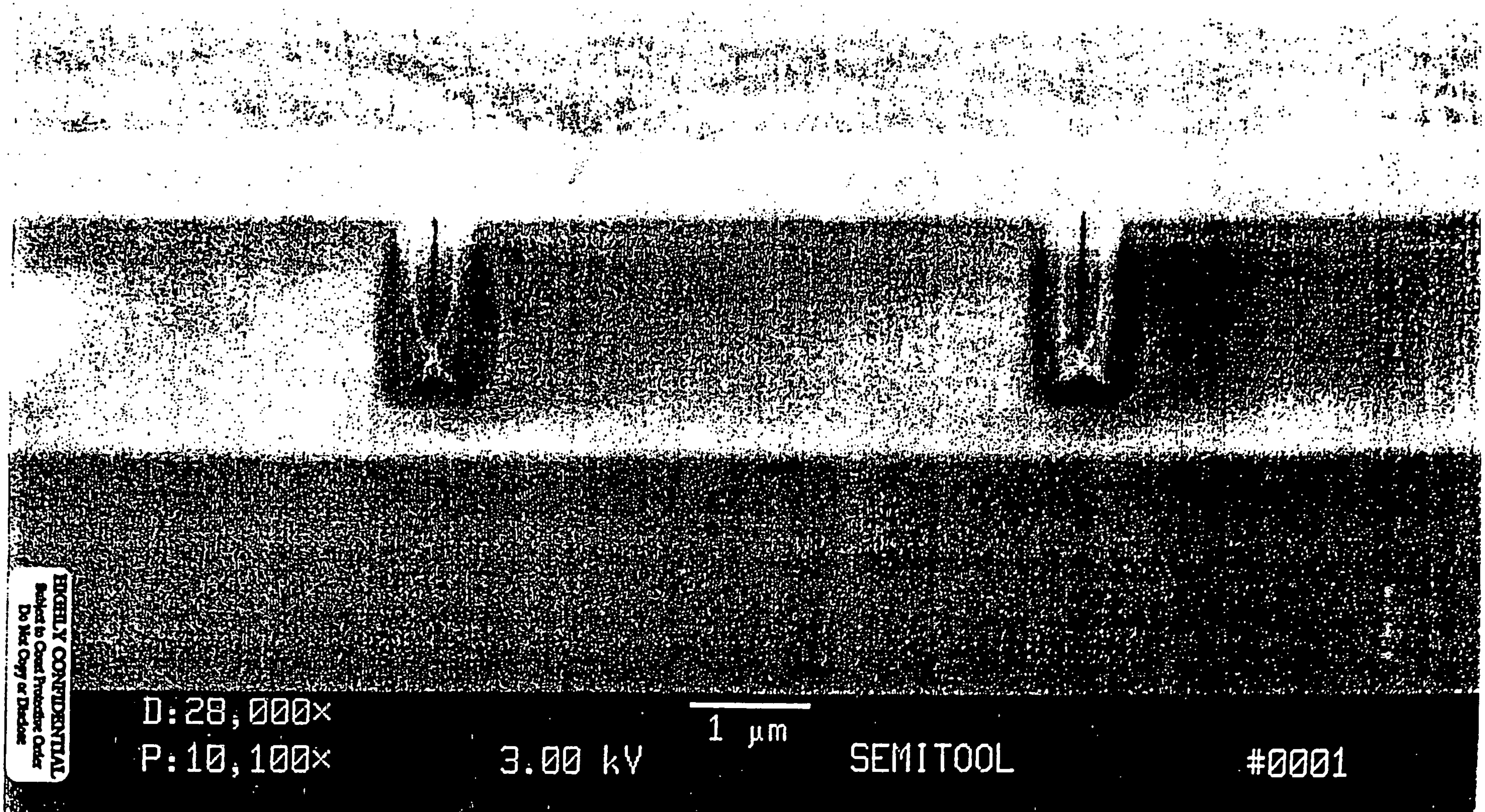
Hardware Generation Roadmap

Semitool Cu ECD Systems

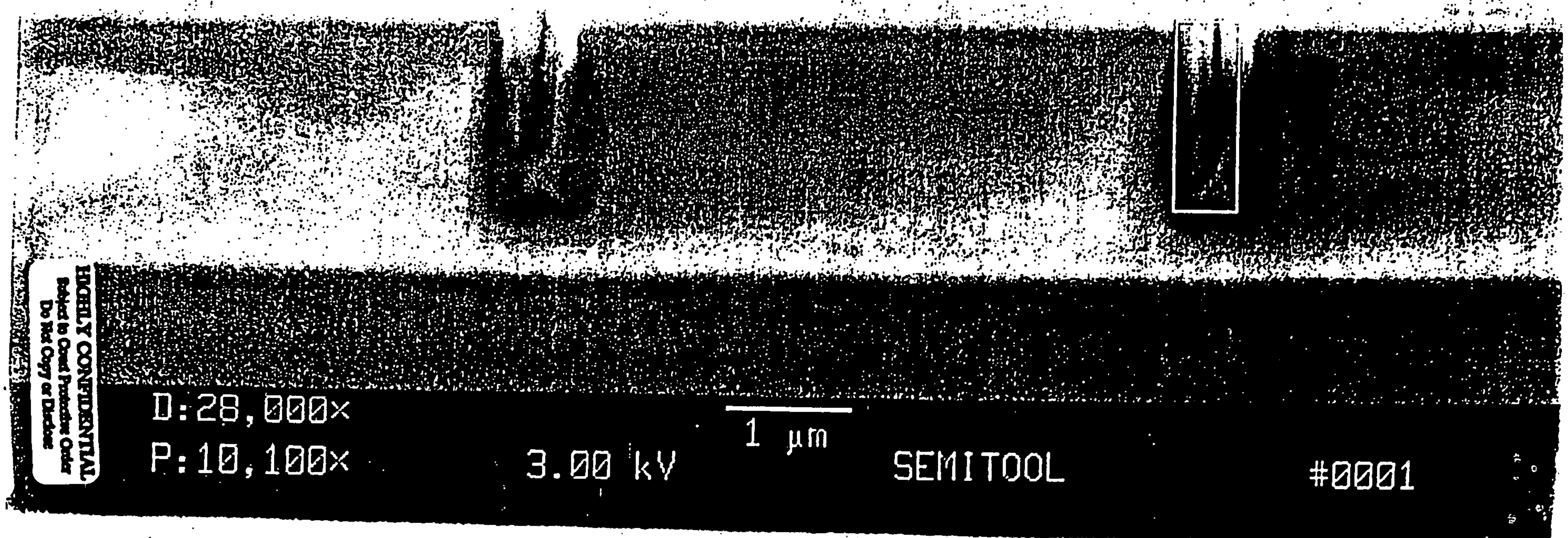
	Feasibility/Development Tools 1995 -> 1996	*IRONMAN Tool Generation 1* 1996 -> 1997	*Production Tool Generation 2* 1997 -> 1998	*300mm ECD* 1998 -> 1999	*300mm ECD* 1999-> 2000	*300mm ECD* 2000 -> 2001
Flow Rate Range	2 - 6 gpm	2 - 9 gpm	1 - 10 gpm	1 - 10 gpm	1 - 10 gpm multi-step programmable	1 - 10 gpm multi-step programmable
Flow Variation Chamber-to-chamber	0.5 gpm	0.5 gpm	0.2 gpm	0.2 gpm	0.1 gpm	0.1 gpm
Electrolyte Temperature	25 +/- 5 deg. C	25 +/- 5 deg. C	40 +/- 20 deg. C	40 +/- 20 deg. C	40 +/- 20 deg. C	40 +/- 20 deg. C
Max. Temperature Variation Chamber-to-chamber	5 deg. C	5 deg. C	5 deg. C	2 deg. C	1 deg. C	1 deg. C
Power Supply Range Continuous/Peak	30A / 100A Endpoint on integrated current	30A / 100A Endpoint on integrated current	TBD Endpoint on integrated current	TBD Cell conductance monitor Endpoint on integrated current	TBD Cell conductance monitor Endpoint on plated thickness	TBD Cell conductance monitor Endpoint on plated thickness
Contact Type	Uncoated	Uncoated	Coated	Coated	Sealed/Remote	Sealed/Remote (seed layer enhancement)
Contact Resistance Sensing	None	None	None	In-situ cell voltage sensing	In-situ contact resistance sensing	In-situ contact sensing and biasing
Bath Analysis/ Replenishment	None	Off-line analysis Manual replenishment	Off-line analysis Open loop replenishment	On-line analysis Open-loop replenishment	On-line analysis Feedback-controlled replenishment	On-line analysis Feedback-controlled replenishment
Wafer / Electrolyte Interface Control	Meniscus plating Manual Set-up	Meniscus Plating Manual Set-up	Meniscus plating Metered Stops	Meniscus plating Metered Stops Electrolyte contact sensing	Meniscus plating Programmable stops Electrolyte contact sensing	Wfr edge &backside protection Programmable stops Electrolyte contact sensing
Fluid Flow Path	Anode perimeter	Anode perimeter	Anode perimeter	Anode perimeter	Anode/chamber perimeter	Anode/chamber perimeter
Anode Configuration	Inert anode	Consumable anode	Consumable anode w/ shield	Consumable anode w/ shield	Consumable anode Optimized configuration	Consumable anode Optimized configuration
Auxiliary Electrodes	None	None	Auxiliary cathode Single segment	Auxiliary cathode Multi-segment	Auxiliary cathode Multi-segment	Auxiliary cathode Multi-segment
Diffuser type	Perforated plate	Perforated plate	Perforated plate	Alternative materials Mesh-type	Mesh-type, or none	Mesh-type, or none
Electrolyte Filtration	In-line	In-line	In-line	In-line plus point-of-use	In-line plus point-of-use	In-line plus point-of-use

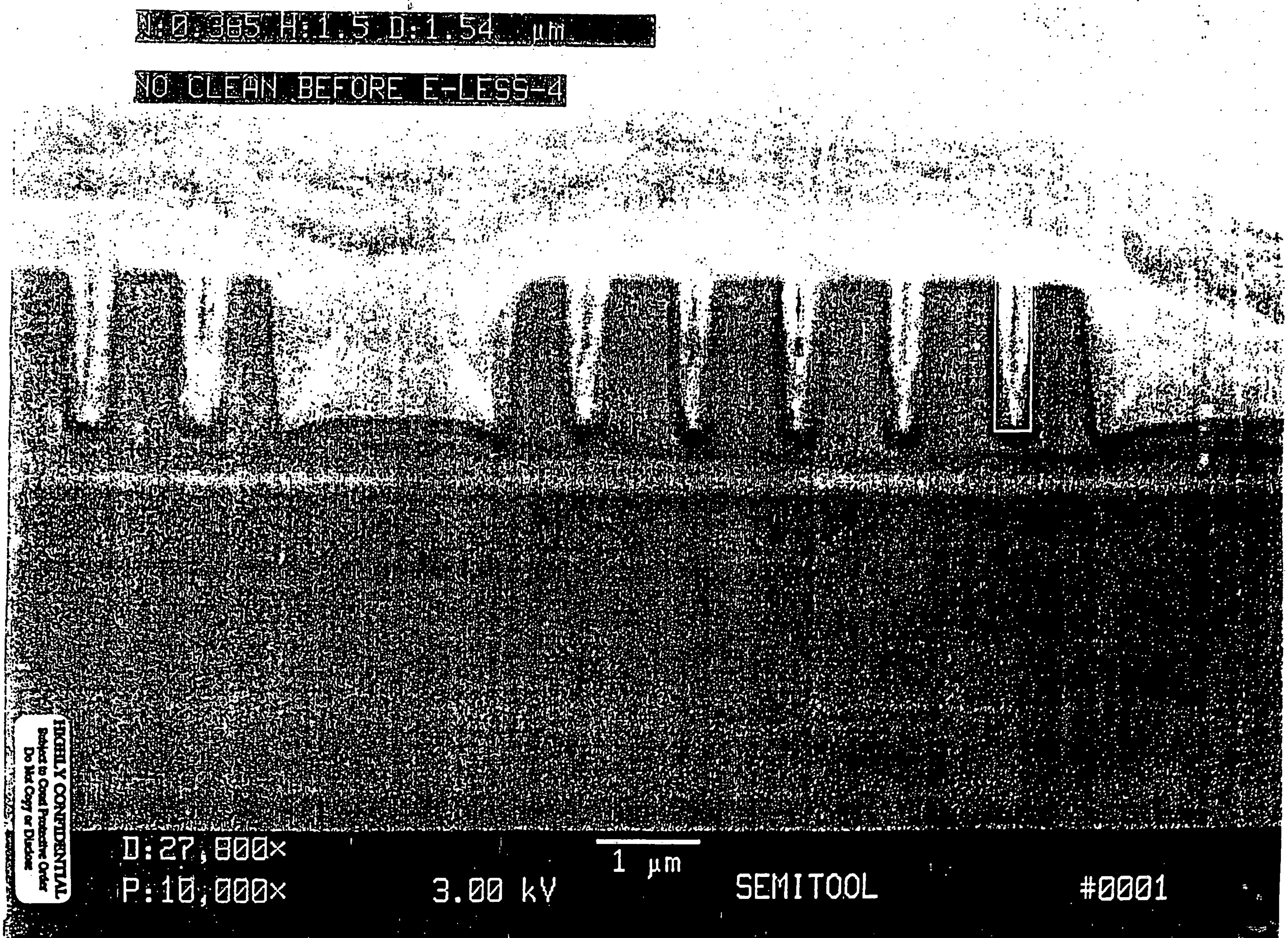
133 nm

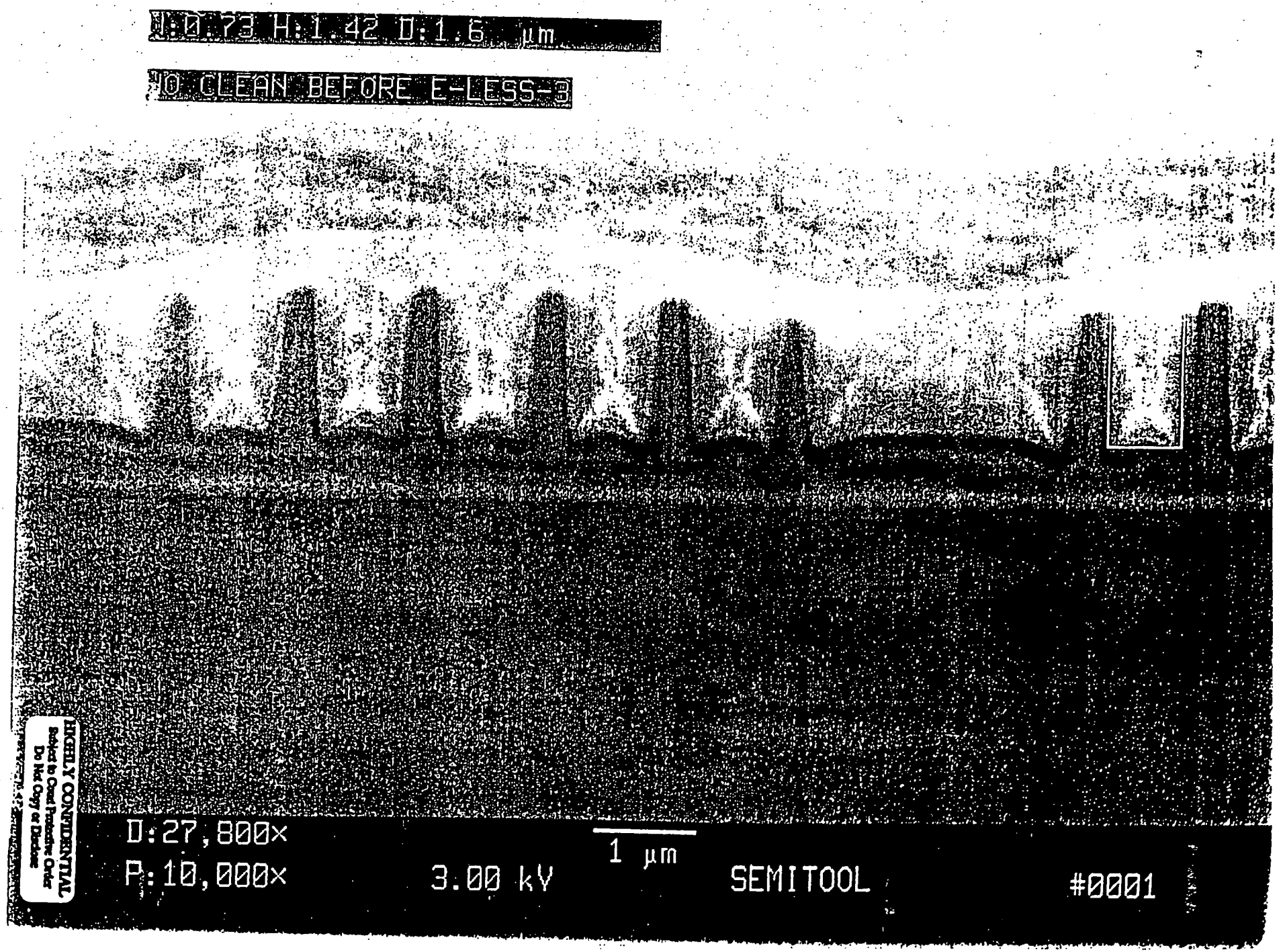
ECD ONLY 341-8



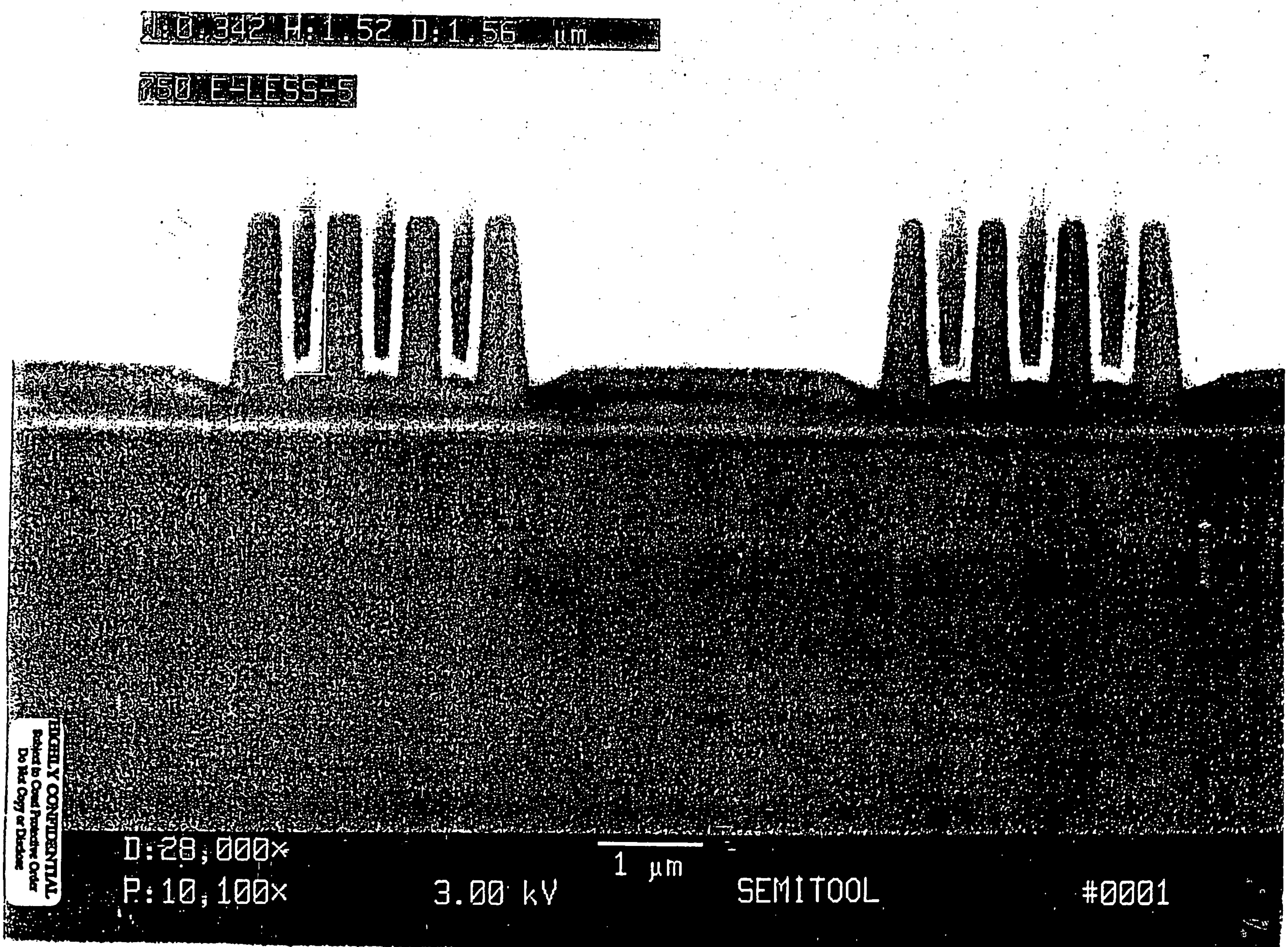
ECD ONLY 341-10



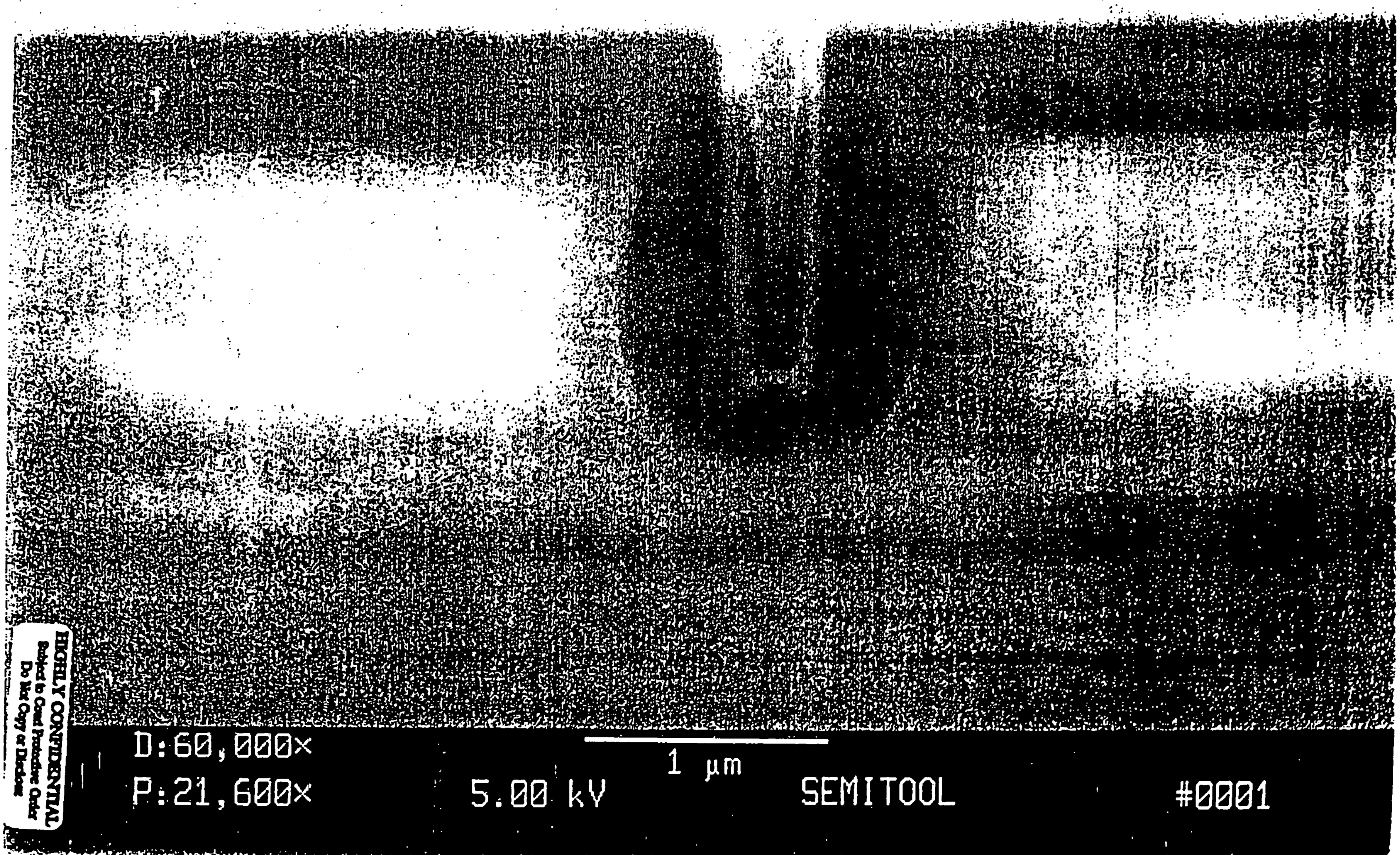



W:0.73 H:1.42 D:1.6 µm
TO CLEAN BEFORE E-LESS-B
HIGHLY CONFIDENTIAL
Subject to Court Protective Order
Do Not Copy or Disclose
D:27,800×
P:10,000×
3.00 kV
1 µm
SEMITOOL
#0001

ST003068



ST003067



wafer exhibit some voids on the walls of the trenches which may be characteristic of seed layer discontinuities, particularly near the bottoms of the trenches.

As a result of the SEM photographs obtained of wafer 381 in which the seed layer and electroless layer were distinguishable by a small barrier, wafers 383 and 387 were prewet for 10 sec in the acid copper make-up solution and then run in an SRD to remove any oxide that may have been present. It is suspected that this prewet step had a negative effect on the electroless and ECD steps as the 10 sec prewet may have removed portions of the existing seed layer to an extent where enhancement through electroless plating was not effective. Photographs labeled SEM 7 and 8 are of voids in the trenches of wafers 383 and 387 respectively. Wafer 387 has the largest voids of the two wafers.

Summary:

Electroless plating was used to enhance the seedlayer of four experimental wafers with some success. The SEM photographs taken of the electroless layer show a uniform enhanced seedlayer in all size trenches and vias. The ECD in combination with the electroless deposition also exhibits good filling capabilities with the exception of pin-holes structures in the smallest trenches and vias.

If you have questions regarding this experiment or future electroless plating experimentation, I can be reached by phone here at Semitool at (406) 752-2107 ex. 7271.

Best Regards,

Matt Johnson

SEMITOOL®
Advanced Technology Process Group
655 West Reserve Drive, PO Box 7010, Kalispell, MT 59904 Phone: 406-752-2107 Fax: 406-752-5522

To: Shu Jin, Chun Mu (INTEL)
From: Matt Johnson
Date: 6/30/97
Subject: Seedlayer enhancement through electroless plating.
cc: Henry Stevens, Bob Berner, Jeff Turner, Linlin Chin

Experiment:

Investigation of electroless plating in combination with ECD for trench/via filling applications.

Process Details:

The electroless bath used was a basic copper sulfate solution with formaldehyde and EDTA used as activation agents. The ECD was performed using a standard commercially available copper make-up solution and a forward only pulse type wave form. Five wafers were plated and the resulting deposition was observed using SEM photography. The following table is a summary of the plating processes used for each wafer.

wafer ID	electroless (Å)	ECD (μm)	prewet
335	750	1.5	no
341	no	1.5	no
381	750	no	no
383	750	1.5	yes
387	1500	1.5	yes

Wafer 381 was initially plated using the electroless deposition only for a total bath time of 2.5 minutes. Photographs labeled SEM 1 and 2 are of this wafer and show an even deposition layer covering the trenches and vias that is approximately 750 Å. The sputtered copper layer and the electroless copper layer can also be distinguished in the photographs.

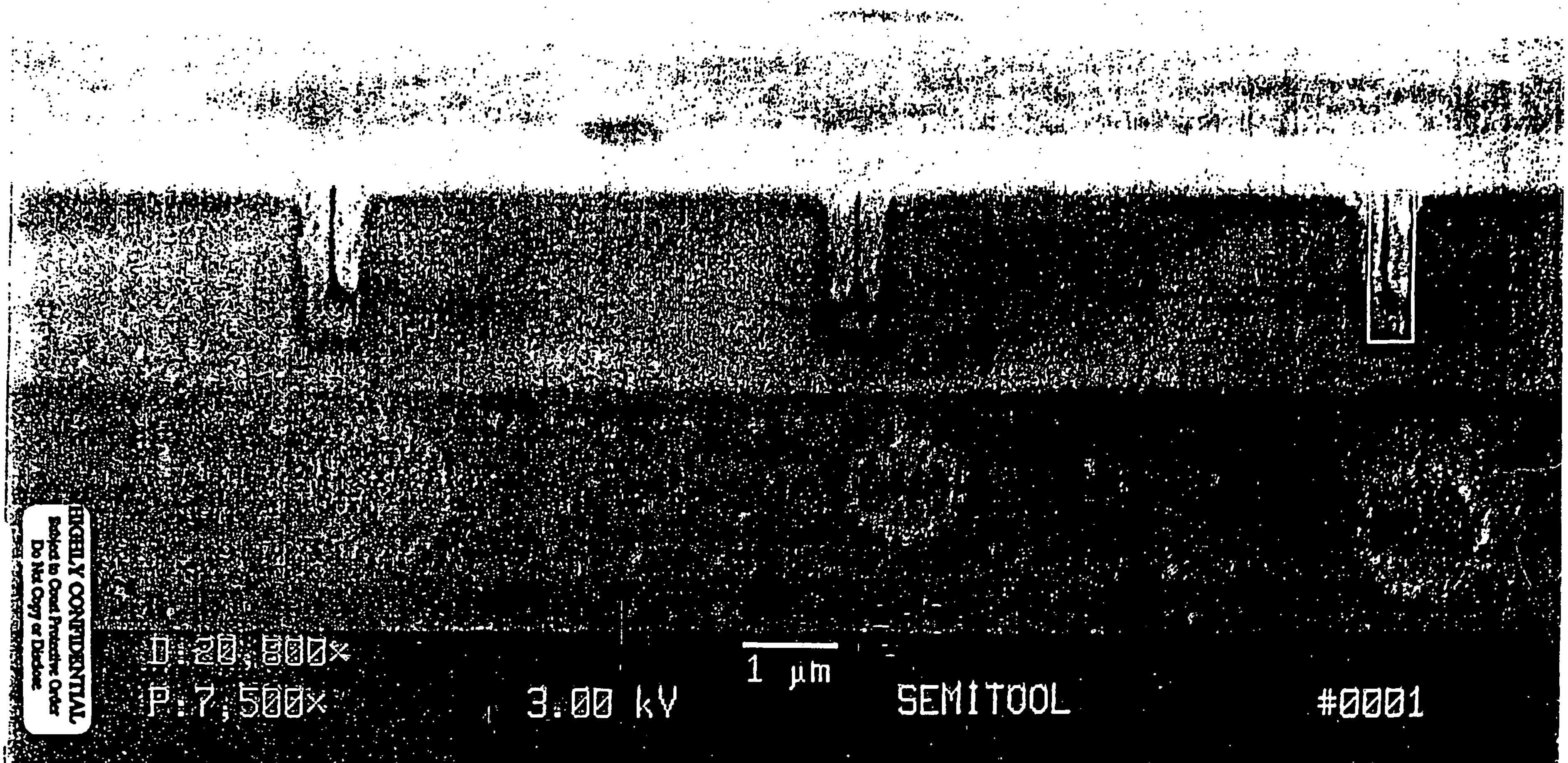
Wafer 335 was also electroless plated to the nominal thickness of 750 μm and then plated using ECD. Photographs labeled SEM 3 and 4 are of this wafer. The structures on this wafer larger than approximately 0.7 μm wide were well filled with no voids. Trenches less than 0.7 μm wide appear to have developed pin-hole structures as a result of the trenches being shut off before complete deposition has occurred.

Wafer 341 was electroplated only and also appears to have good filling characteristics in the larger trenches as shown in photographs SEM 5 and 6. Some of the smaller structures on this

Exhibit N

W:0.486 H:1.59 D:1.66 µm

CLEAN BEFORE E-LESS-1



0.422 H:1.31 D:1.37 µm

ECD E-LESS-335-4

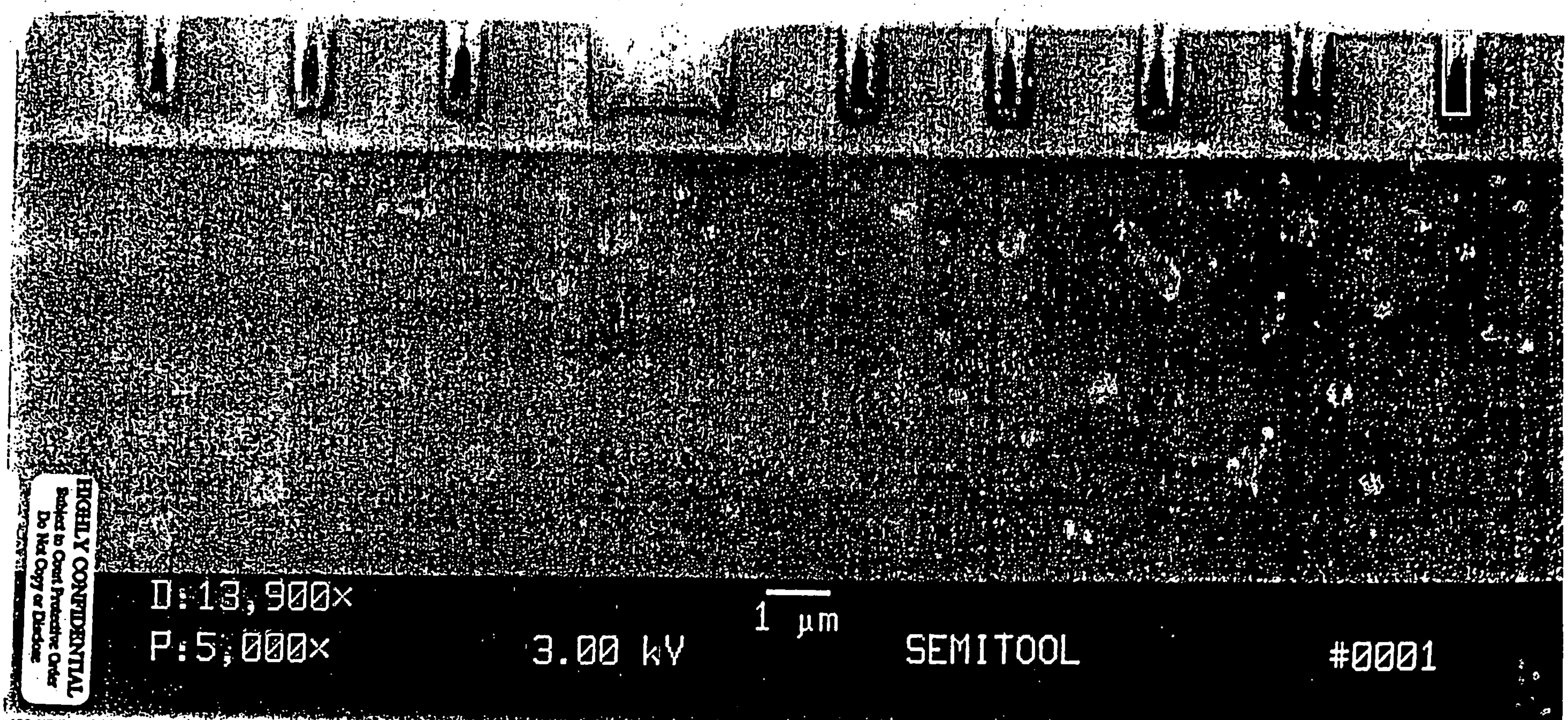


Exhibit O

Attorney Docket No. 291958171US02
Semitool Ref No. P98-0025US3

Express Mail Label _

I hereby certify that this correspondence is being deposited with the U.S. Postal Service with sufficient postage as Express Mail No. EL099017980US in an envelope addressed to: Assistant Commissioner for Patents, Washington, D.C., 20231, on:

Date:_____ By:_____

Melody J. Almberg

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE PATENT APPLICATION NO.:	6,197,181
APPLICATION NO.:	09/045,245
FILED:	MARCH 20, 1998
ISSUED:	MARCH 6, 2001
FOR:	**METHOD FOR ELECTROLYTICALLY DEPOSITING METAL ON A MICROELECTRONIC WORKPIECE**

Declaration of Harry M. Cross, Jr. In Support of Joint Inventorship

1. I, Harry M. Cross, Jr., am Corporate Counsel of Semitool, Inc. (Semitool) located in Kalispell, Montana.

2. Based upon recently discovered documentary evidence, and recent statements from Mr. Thomas Taylor (Taylor) and Mr. Lin Lin Chen (Chen), Taylor is a co-inventor of (a) certain subject matter claimed U.S. Patent No. 6,197,181 ("the '181 Patent") and (b) subject matter claimed in U.S. Application No. 10/302,711 as set forth in the Preliminary Amendment filed on November 22, 2002.

3. In April 1997, Taylor was a team leader within the Advanced Technology Group ("ATG") of Semitool, and he was involved with developing new technologies for improving seed layers.

4. On April 4, 1997, the Semitool ATG group held a meeting that included a discussion of Semitool's current developments in seed layer technology. During this

meeting, Taylor presented information about Semitool's efforts to improve and optimize seed layers by using an electroless process to perform seed layer enhancement. According to Taylor, the seed layers to be enhanced were thin seed layers in the range of 200-500Å, and the purpose of the electroless enhancement process was to fix deficiencies (i.e., voids and discontinuities) in the seed layer before using an electroplating procedure to bulk fill copper on the seed layer.

5. After April 4, 1997, Taylor designed experiments to demonstrate the electroless enhancement process to Intel Corporation (Intel). On May 1, 1997, Taylor sent a confidential memorandum to Intel regarding his proposal to supplement the step coverage of PVD seed layers by a short electroless copper deposition process before beginning electrolytic plating. Between May 1 and June 30, 1997, Semitool performed the electroless seed layer enhancement experiments designed by Taylor.

6. Semitool prepared a confidential report dated June 30, 1997, regarding the experiments designed by Taylor. The results of these experiments established that the electroless process designed by Taylor was effective in eliminating deficiencies in seed layers for structures having a width larger than approximately 0.7 μm.

7. Although the electroless procedures designed by Taylor successfully repaired defective seed layers with certain characteristics, and although they also showed promise of greater success with further development, Semitool decided to devote its resources to other priorities.

8. Chen, the sole inventor named in the '181 Patent, began working for Semitool on April 14, 1997. Chen was not present at the ATG group meeting on April 4, 1997, but he later received a copy of the June 30, 1997, report describing Taylor's electroless seed layer enhancement experiment. Chen received a copy of this report to bring him up to speed on Semitool's current activities regarding seed layers and to solicit his feedback for improvements regarding Semitool's research and development activities.

9. In the middle of 1997, Taylor transferred from the Semitool ATG group to the Semitool marketing department. Taylor did not have direct involvement with developing processes for enhancing seed layers after this time.

10. In September 1997, I joined Semitool as a part-time consultant for three days a week.

11. In November 1997, Mr. Robert Berner, Corporate Vice President of Technology for Semitool, terminated his employment with Semitool to work for a different company. Although Mr. Berner was made aware of Taylor's previous work regarding electroless processing of seed layers, he did not inform me of Taylor's earlier work in the short time that we were both at Semitool. Also, after leaving Semitool, Berner was not available to assist me in coordinating the intellectual property of Semitool.

12. In late 1997, Chen began focusing on methods to fix deficiencies in seed layers. On December 22, 1997, Chen conceived of an electrolytic seed layer repair process, which is the preferred embodiment of the invention described in the '181 Patent.

13. The application for the '181 Patent was filed on March 20, 1998. Although certain claims in the '181 Patent cover electroless processing of a deficient seed layer, Taylor was inadvertently not named as an inventor on the application for the '181 patent.

14. On May 1, 1998, after (a) Taylor had transferred to marketing, (b) Berner had left Semitool, and (c) the application for the '181 Patent had been filed, I became a full-time employee of Semitool and assumed full responsibility for Semitool's intellectual property. Because of the personnel and organizational changes at Semitool involving Taylor and Berner in mid to late 1997, and also because of my being a part-time consultant from September 1997 to May 1, 1998, Semitool simply inadvertently lost track of the work that Taylor and Semitool had performed using an electroless process to enhance deficient seed layers.

15. I only recently became aware and confirmed that Taylor had made an inventive contribution to seed layer the repair processes covered in certain claims of '181 Patent and U.S. Application No. 09/694,413.

16. After allowance of several claims in U.S. Application No. 09/694,413, Semitool cancelled claims in that application which were jointly invented by Taylor and Chen, and only allowed subject matter invented solely by Chen to proceed to allowance.

17. Semitool is pursuing the allowed and subsequently cancelled claims from U.S. Application No. 09/694,413 that were jointly invented by Chen and Taylor in U.S. Application No. 10/302,711.

18. Based on the foregoing, the error in inventorship of failing to name Taylor as a joint inventor of certain claimed subject matter of the '181 Patent occurred without any deceptive intention on the part of Taylor, Chen or others involved with the prosecution of the '181 Patent or U.S. Application No. 09/694,413.

19. I declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further, that all statements were made with the knowledge that making willfully false statements and the like is punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and may jeopardize the validity of any patent issuing from this patent application.

This Declaration is executed on the ____ day of May, 2003.

Date: 5/22/03

Harry M. Cross, Jr.
Registration No. 22,229

Correspondence Address:
Customer No. 25096
Perkins Coie LLP
P.O. Box 1247
Seattle, Washington 98111-1247
(206) 583-8888